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Mechanical side of a

MECHANICAL SIDE OF ANATOMICAL ARTICULATION

BY GEORGE WOOD CLAPP, D.D.S.

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Mechanical Side
OF
Anatomical Articulation

By
GEORGE WOOD CLAPP, D.D.S.
NEW YORK

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THE MECHANICAL SIDE OF ANATOMICAL ARTICULATION

CHAPTER I

FUNDAMENTAL CONSIDERATIONS

When artificial dentures are anatomically articulated* neither denture will be dislodged during the act of crushing food. This is probably true in the fullest sense only when full upper and lower plates are made together. But it is true in a larger sense than is usually taken advantage of when partial plates are made, or either plate is made to articulate with opposing natural teeth. The principles of anatomical articulation may be applied to bridgework, and the stress to which an extensive bridge is subjected may be so distributed and equalized as to greatly lessen the strain on the abutments.

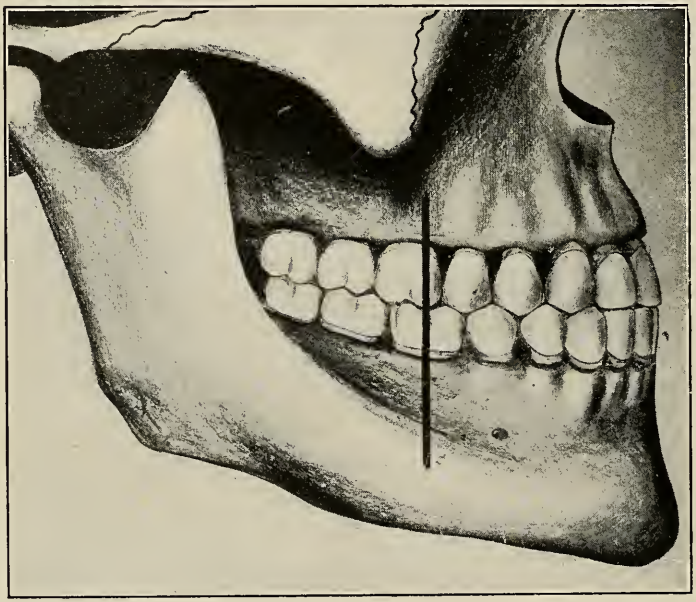
These desirable ends may be attained by following certain mechanical steps. The worker need not be a theorist to attain them.† It is the purpose to here make the principles of anatomical articulation and their mechanical application so plain that any ambitious dentist can apply them. The illustrations are from practical cases.

* The distinction between occlusion, or the simple meeting of the morsal surfaces of the teeth of the upper and lower sets (something which may be secured with almost any arrangement of the teeth of one set, those of the other being fitted to them), and articulation, in which contact of the teeth of the two sets will occur at a number of widely distributed points when the mandible is moved laterally, as in mastication, has not received the attention that it should have done.—Snow.

† No one should minimize the necessity of theoretical investigations, or the credit due the investigators. Only the labors of a long line of workers, among whom Bonwill was a leader, and of whom Drs. Prothero, Snow, Turner, Cross, Gritman and others, yet remain among us, have made this work possible. And the writer gladly acknowledges that these papers are built almost wholly on the foundation these men have laid. Originality is here claimed only as to the method of presentation and a few mechanical methods. In this connection many valuable suggestions have been received from Dr. E. S. Ulsaver.

No other phase of dental practice is so greatly misjudged and underestimated as plate work. It is looked upon as a labor which does not require either great skill or close attention. Only too often it is committed to unskilled hands or discharged with a minimum of attention by men who willingly bestow any amount of toil in other departments of practice.

This underestimation results wholly from the lack of proper knowledge concerning the requirements for and possibilities of plate work. No other phase of practice, save orthodontia and oral surgery, requires such extended knowledge as successful denture making. Save possibly in these two branches, no other form of dentistry brings to the worker



Ill. No. 1.—Diagrammatic illustration of the relations of the jaws in occlusion. By noting the location of the vertical black line, the movements of the mandible from this position may be better understood.*

more numerous, more complex or more difficult problems. More than cavity preparation, more than inlay making, the making of dentures demands knowledge and skill, and offers opportunities for visible success or glaring failure.

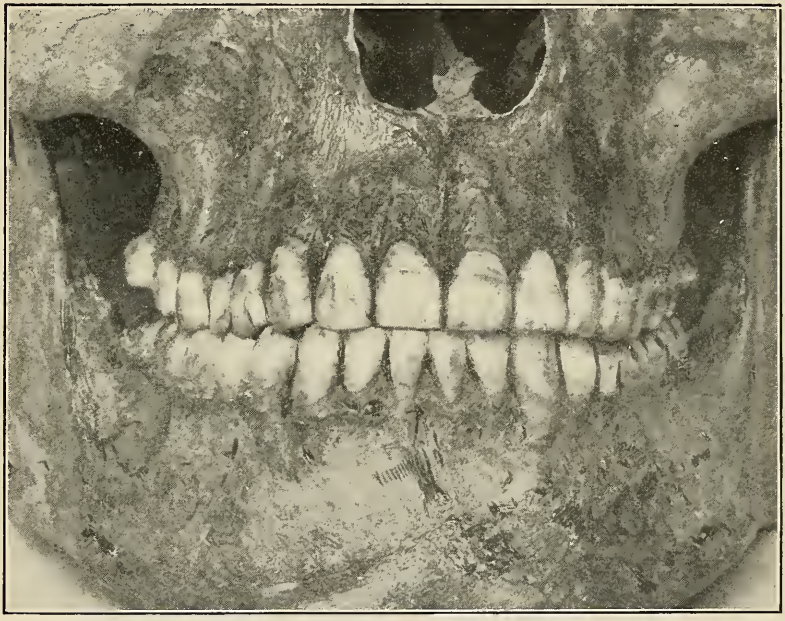
The dentist who has mastered plate work never underestimates it. And when dentists as a whole understand that the present low estimate

* This illustration and Nos. 7 and 9 are published by courtesy of W. J. Brady, D.D.S.

obtains only because we, as a profession, have neither solved the problems involved in anatomical articulation nor grasped the possibilities it offers, attention will be given to this branch of dentistry which will bring plate work to its own.

Three considerations commend the making of anatomically articulated dentures.

The first is professional. People who have lost the natural teeth are wholly dependent on the dentist for satisfactory substitutes. These are necessary to proper grinding and insalivation of food, to natural,



ILL. No. 2.—Full front view of two complete natural dentures with good articulation save in third molars.

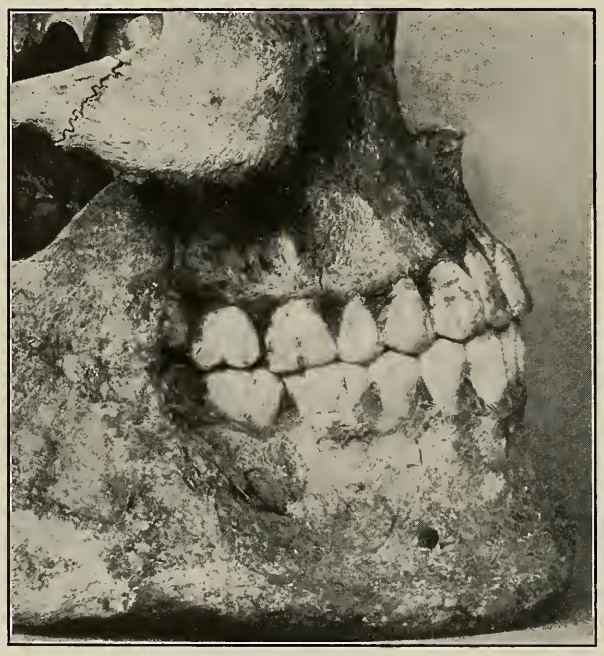
easy digestion, to proper assimilation and energy production. Thus the questions of health and longevity for many of our patients come directly to our doors.

Only when edentulous patients are provided with *properly articulated* plates can they properly masticate food. Improperly articulated plates masticate very poorly, and digestive troubles usually result.

It is our professional duty to serve these patients well. It is possible to serve them quite as efficiently as those who come for restoration of decayed teeth. Anatomically articulated dentures will enable

such patients to masticate thoroughly all suitable articles of food and to secure nutriment without undue strain on the digestive system. We have no professional right to neglect such patients or to serve them poorly, when further knowledge on our part would enable us to serve them well.

The second consideration is physical. It is closely related to our own health and the prolongation of our working lives. It may be summed up by saying that the dentist who alternates well-done plate work with operative work will retain his physical vigor longer than he whose work is wholly operative. Plate work, by the methods to be



Ill. No. 3.—Side view of same dentures as in Ill. No. 2. Note how the buccal cusp of each upper bicuspid and molar rests above an interdental space or a buccal groove of the lowers. In the mesio-buccal cusp of the upper first molar this relation is not perfect in this skull.

described, provides mental relaxation from the high nervous tension of operative work. And when anatomically articulated dentures serve edentulous patients satisfactorily, the hours spent at the bench will provide rest, satisfaction and mental rejuvenation.

The third consideration is financial. Plate work can be made as profitable as operating. The fees for plate work are generally low, but

they seem to be as high as the quality of work warrants. Those dentists who make properly articulated dentures, and add to their professional skill reasonable skill in selling their services, have little difficulty in getting remunerative fees.

For the dentist who is now making dentures in the ordinary manner and is receiving unsatisfactory fees, an attractive future is open. If he will anatomically articulate dentures for appreciative patients,

Ill. No. 4.—Buccal view of natural dentures exhibiting practically perfect articulation. Note how perfectly the upper buccal cusps close over the interdental spaces or buccal grooves of the lowers.*

he will find his hours at the bench as remunerative as those spent at the chair.

A DEFINITION OF ANATOMICAL ARTICULATION

Before we can enter upon the detailed study necessary to anatomically articulate dentures, we must have a definition of what anatomical articulation is. While many definitions are possible, the following is free from technical difficulties, and seems to meet all requirements.

* This photo and Nos. 5 and 6 are from Turner's Prosthetic Dentistry, and are reproduced by the courtesy of Messrs. Lea & Febiger, Philadelphia, Publishers.

"Artificial dentures are anatomically articulated when they exhibit the characteristics of articulation common to the best natural dentures."

It is evident, then, that we should get our detailed information as to what anatomical articulation is by studying the best obtainable specimens of natural dentures. Good natural dentures are rare. A noted plate worker, who has made a study of articulation, says that in forty years of practice he has seen only three dentures which he

Ill. No. 5.—Lingual view of two perfect human dentures. Note how the upper lingual cusps fit into the fossæ and interdental spaces of the lower teeth. It is this close adaptation which is desired as the first requisite in artificial teeth.

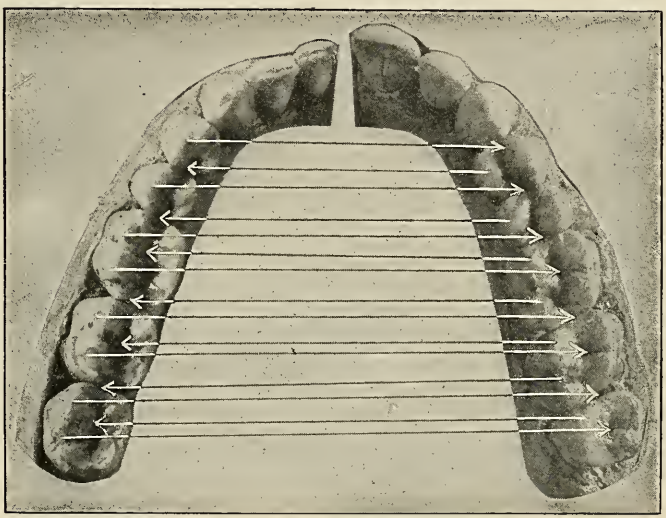
regarded as practically perfect. An examination of over 1,500 skulls in the Museum of Natural History, City of New York, revealed only three dentures likely to be of value as subjects of study.

Three great facts characterize perfect natural dentures. They may be stated in advance, to be studied in detail later. They are:

1. When the mandible is thrown to one side and brought into contact with the upper teeth, the lower teeth are in contact with the uppers at three widely separated points. On the side engaged in crushing the food, the lower teeth from central to third molar are in contact with the opposing uppers. The lower third molar on the opposite side is

in contact with the upper second molar. In artificial dentures this form of contact prevents dislodgment of either plate and permits the exertion of an amount of force otherwise impossible. It has been erroneously styled "three point contact," but there is contact at more than three points.

2. When the teeth are in lateral occlusion, the buccal cusps of the lowers are laterally in line with the buccal cusps of the uppers. The lingual cusps of the lowers are in line with the lingual cusps of the



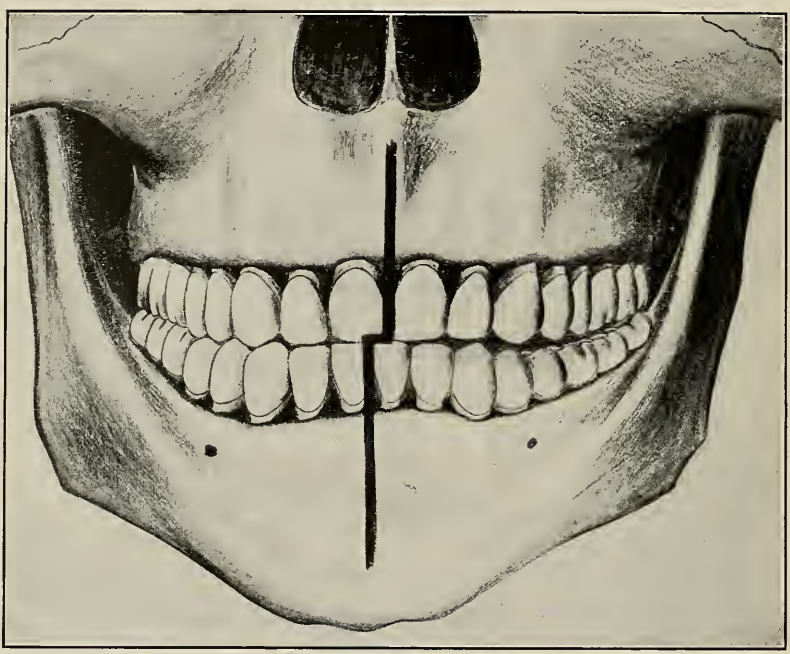
Ill. No. 6.—On the left, half of a lower natural denture. On the right, half of the upper denture opposed to this lower. Arrows lead from the cusps of one set to the fossa or interdental space into which that cusp closes in a position of central occlusion.

uppers. The sulci and fossæ of the opposed occlusal surfaces form a space known as the rectangular groove. In this groove the food is compressed.

3. The food in the rectangular groove is finally crushed by the mandible sliding toward the median line. The buccal cusps of either set, on the side engaged in crushing, slide through the spaces between the teeth of the other set, or through buccal grooves. This relation of cusps to grooves, with the aid of the articulating molars on the opposite side of the mouth, prevents the dislodgment of dentures made on this principle.

The lingual cusps move through interdental spaces or lingual grooves in a similar manner.

Illustrations 1, 2, 3 and 4 illustrate two well-articulated natural dentures in position of occlusion. This is the position from which the mandible starts on its lateral excursion,* and the position in which it



Ill. No. 7.—Diagrammatic illustration showing the lateral movement of the mandible. The mandible has moved downward, sideways and upward, and is now ready to begin the final crushing movement. The buccal cusps of the bicuspids and molars on the right side are in the same vertical plane and interdigitated. The final crushing movement will be accomplished by the sliding of the mandible back to a position of occlusion. This distance is shown by the offset in the vertical line.†

rests at the end of the triturating movement. We can arrive at some valuable data by a study of the occlusion as here exhibited.

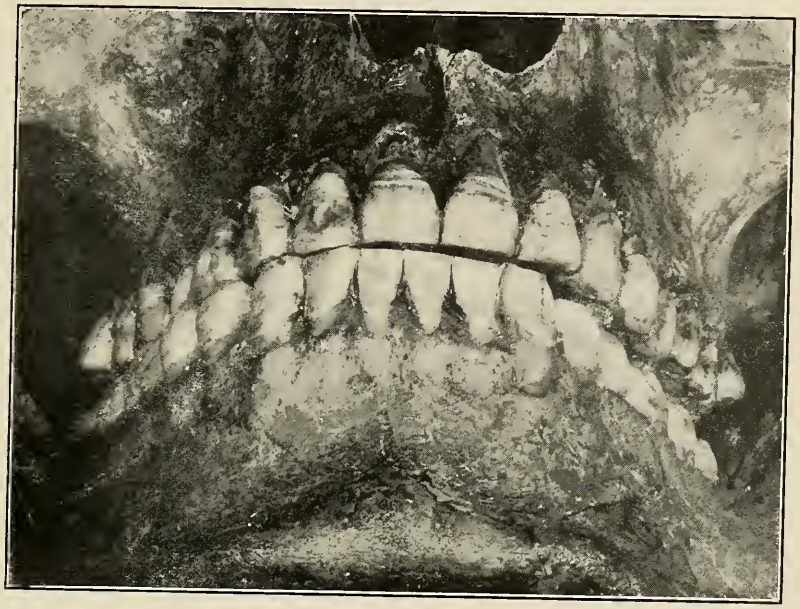
It will be seen that the upper teeth bite outside of the lowers. This overbite serves to keep the tissues of the cheeks from between the teeth, and is part of the mechanism by which Nature secures proper crushing of the food. Beginning with the first bicuspid and extending back to the third molar, the occlusal surfaces of the upper teeth show a con-

* It is quite possible that the normal position of the jaws in life during periods of rest is with the teeth slightly separated. They are probably brought together only as the result of nervous impulses.

† Shown by the courtesy of W. J. Brady, D.D.S.

tinuous groove, narrow in some places and wide in others. Into this groove the buccal cusps of the lower bicuspids and molars fit. When the teeth have been slightly worn by the processes of mastication, the fit of the cusps into the sulci and fossæ of the opposing teeth is nearly perfect.

The occlusal surfaces of the lower bicuspids and molars beginning



Ill. No. 8.—Natural dentures in position illustrated diagrammatically in Illustration No. 7. Seen somewhat from below. From the right lateral backward, both dentures are in close contact, the buccal cusps of the posteriors being interdigitated. The lower left third molar is in contact with the upper left second molar, establishing balance. The teeth are considerably worn by use.

with the second bicuspid, show a similar groove, and into this groove the lingual cusps of the upper bicuspids and molars fit.

POSITIONS OF THE TEETH IN THE LATERAL EXCURSION OF THE MANDIBLE

When the jaw starts on that movement which is to end in the triturating of food, it moves downward and to the right (or perhaps to the left). It thus separates the occlusal surfaces of the teeth and into the space thus provided the cheek and tongue thrust the food to be triturated. The mandible, still held to the side, moves upward and comes in contact with the upper jaw in such position that the buccal cusps of the lower bicuspids and molars, on the side engaged in crush-

ing food, are in nearly the same vertical plane with the corresponding cusps of the upper teeth, and interdigitated with them. This contact is often continuous from the lower left and upper right centrals to the third molars of both sets.* So close is the adaptation of the upper and lower buccal marginal ridges that the escape of any large particles of food from between the occlusal surfaces of the teeth is prevented. Similar adaptation of the lingual cusps of the upper and lower teeth largely prevents escape of food in that direction. The food thus locked in position is ready for the final triturating.

This is accomplished by the sliding of the mandible toward the median line of the head until it comes to rest with the buccal cusps of the lower bicuspids and molars in the fossæ of the uppers.† In sliding thus back to place, each cusp of each posterior tooth passes through its appropriate groove or interdental space in the opposing set.

By this motion of the teeth the food is finely crushed.‡

Meantime, on the other side of the jaw an important adaptation has occurred. The downward and sideways swing of the mandible brought the lower left third molar forward and inward. When the upward move of the mandible brought the teeth on the crushing side into contact, the buccal cusps of the lower third molar came into contact with the lingual cusp of the upper left second molar. This, like the contact on the crushing side, is a sliding contact. It is made at the same time as the contact on the crushing side, and is maintained in the same manner throughout the crushing movement. It has great value. The force often required to crush food§ is so distributed by this "balancing contact" that all tendency to tilt or twist the mandible is obviated. The mandible is in sliding contact with the upper jaw at the three most widely separated points, at the lower left third molar and continuously from the lower centrals to the right third molar.

As the mandible is thus relieved of all tendency to tilt, the power ful temporal and masseter muscles *of both sides* are free to asist in

* It is not the intention to here enter into a consideration of the Curve of Spee and the lateral curve which make these relations possible, but merely to outline what the relations are.

† This final triturating movement is very short, probably not greater than half the width of the occlusal surface of the upper first bicuspid at the position of that tooth. Dr. J. Leon Williams believes it to be very much less than that, perhaps not more than one one-hundredth of an inch.

‡ The writer suggests that the upward movement of the mandible, which crushes the food, be known as "the crushing movement," and the final movement as "the triturating movement." Of course these terms are for descriptive use, since the movement is really all one.

§ For some common articles of food a crushing force of 200 pounds is required.

the crushing of food on either side. The crushing power is thereby greatly increased.

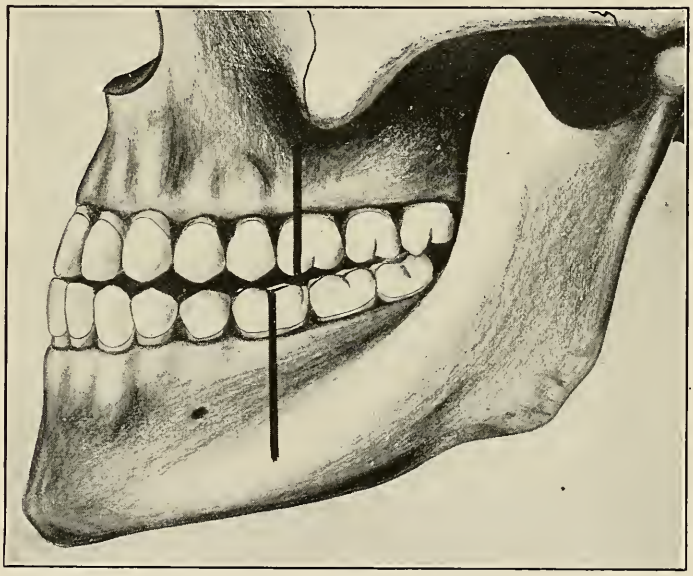
A realization of the importance of this balancing contact will be of great value to the plate worker.

Having sketched in outline the positions of the teeth in occlusion and in the crushing and triturating movements, let us examine their relations in the act of biting.

POSITIONS OF THE TEETH IN BITING

Food is bitten with the incisors. It should be triturated with the bicuspids and molars.

To bite off food the mandible moves downward and forward from



ILL. No. 9.—Diagram illustrating the forward movement of the mandible to produce the end to end bite. When the mandible is in central occlusion, the vertical black line is continuous.*

its position of rest, and then upward, the lower incisors coming into contact with the uppers in a protruded position. This protrusion varies in different cases. Its possible range varies considerably in any normal mouth.

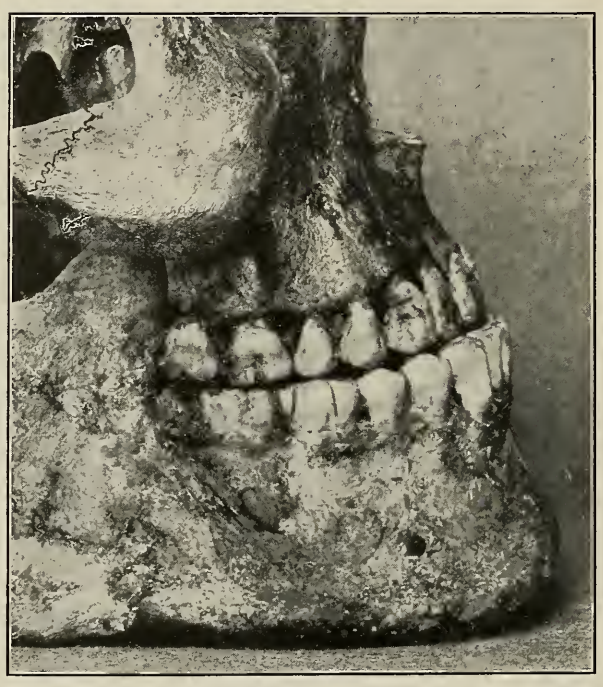
Probably the most common form of incisive bite is for the cutting

* Shown by the courtesy of W. J. Brady, D.D.S.

edges of the upper and lower incisors to come into end-to-end contact. To complete the biting movement the lower incisors slide backward and upward against the lingual surfaces of the uppers, shearing off the food.

When the upper and lower incisors are widely separated, there is no contact between the posterior teeth.*

When the cutting edges of the incisors come into contact, the pos-



Ill. No. 10.—Same natural dentures as in Nos. 2, 3, and 8. Here shown in extreme protrusion bite. Lower incisors well in front of uppers. Buccal cusps of both dentures in contact. The mandible is protruded farther than customary in incising. The "shearing off" movement can be accomplished only by the mandible sliding backward till the lower incisors are slightly behind the uppers, and then upward. At the same time all other teeth slide to occlusion.

terior teeth are in contact throughout the range of both dentures, though the form of contact is quite different from that maintained during the crushing movement. In many cases, at least, the mandible moves forward about half the mesio-distal width of a bicuspid to establish the end-to-end bite of the incisors. The buccal cusp of the upper first bicuspid

* The patient wearing artificial dentures must prevent dislodgment during their complete separation by not taking too large bites, and by pushing inward on the food while the teeth bite it off.

will then be found directly above the buccal cusp of the lower second bicuspid, as shown in the illustrations herewith.

This contact throughout both sets is attained by the peculiar antero-

ILL. No. 11.—Two excellent natural dentures in occlusion. The separation between the upper centrals is congenital and is equalled by the spaces between the lower centrals and laterals. The dentures are complete, are practically unworn, and exhibit no decay. The occlusion is excellent.

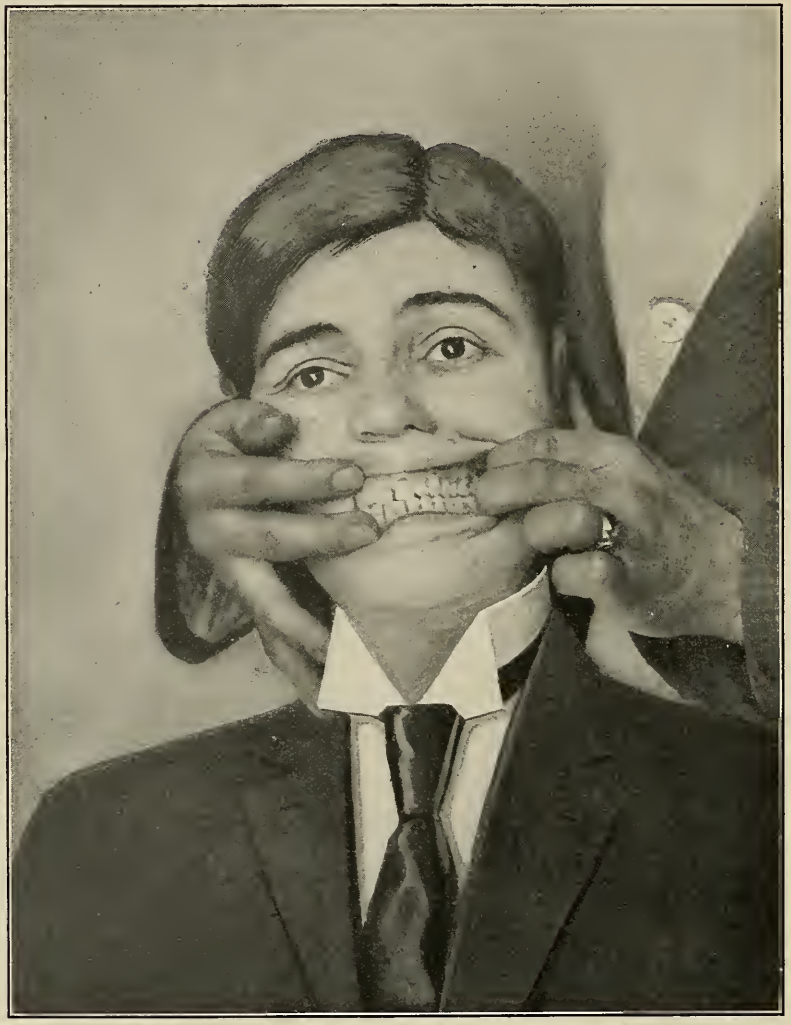
posterior curve of the occlusal surfaces, known as the Compensating Curve or the Curve of Spee.

The sliding backward and upward of the lower incisors, to complete the incisive or shearing movement, is made possible by the simul-

taneous sliding of all other cusps on the inclined planes of the opposing teeth to again occupy the position of rest.

What does this advance reading show us?

It gives us our first glimpse of the mechanical plans underlying the



Ill. No. 12.—The mandible thrown forward in end-to-end bite. The cusp of the upper cuspid is above and in contact with the cusp of the lower first bicuspid. Practically similar opposition of upper and lower buccal cusps obtains throughout the range of both dentures.

articulation of good natural dentures in such way that we may apply the same principles to the articulation of artificial dentures.

We see, first, that in the position of direct occlusion and that of

lateral occlusion the teeth interdigitate with almost the accuracy of gear teeth. We see also that in all positions where great force is to be exerted, the mandible lies in contact with the upper denture at three or more widely separated points. By thus supporting the mandible against tipping, it is possible for the temporal and masseter muscles *of both sides* to exert their power in the final biting or shearing movement, and in the final crushing movement. The power of the jaw is thus greatly increased over that which would result from the pull of only one set of these muscles.

Great as are the advantages of these mechanical arrangements to the natural denture, those resulting from similar articulation of artificial dentures are greater. The teeth of the natural denture cannot be easily dislodged, but if the artificial dentures are poorly articulated, they may be so easily dislodged as to make mastication impracticable.

When, however, artificial dentures are made on the principles of which we have here caught the first glimpse, they are very stable as to position, and they make possible the exercise, in biting and grinding, of forces wholly impossible otherwise.

CHAPTER II

THE TRIAL PLATES

We have now learned what are the characteristics of articulation as exhibited by the best natural dentures, and may proceed with those steps which will reproduce such articulation in the artificial dentures.

Good dentures presuppose good impressions and good models of both jaws.*

Over each model a base plate of base-plate composition should be shaped and trimmed to approximately the area the plate is to occupy. These base plates might be made of wax or of modeling composition, but the manipulation to which they are to be subjected makes it advisable that base-plate composition be used. This can be obtained at any dental depot. It is easily shaped when warm and very stable when cold. It may be accurately adapted to the model, permits getting suction under the upper trial plate and assists in making a thin and even denture over the vault.

When this base plate has been adapted to the upper model and trimmed to approximate shape, it is transferred to the mouth and fitted just as a gold base would be. It should be as high all round as may be without being displaced by the downward pull of the muscles.† The retention may sometimes be greatly increased by making the rim high from the second bicuspids to the heels.

The upper base plate is left in this condition while a step slightly in anticipation of our immediate requirements is taken. That step is to draw on the patient's face, by the aid of a ruler, a line from the

* It is assumed that full upper and lower dentures for one mouth are being made together.

† The height may be determined by trying the base plate in the mouth and then pulling the cheeks and lips downward. The sides should be trimmed until the base cannot be dislodged in this manner. There should be good clearance at the frenum and at the buccal strings.

lowest point of the external auditory meatus* to the lowest point of the ala of the nose. This line may be seen in Illustration No. 13. Its use will be shown presently.

Ill. No. 13.—Making pressure on the knife blade to bring it parallel with the line on the face. This determines the occlusal plane of the bites.

Any moisture present on the upper base plate is now dried. A sheet of base plate wax is cut to about two-thirds its usual length and

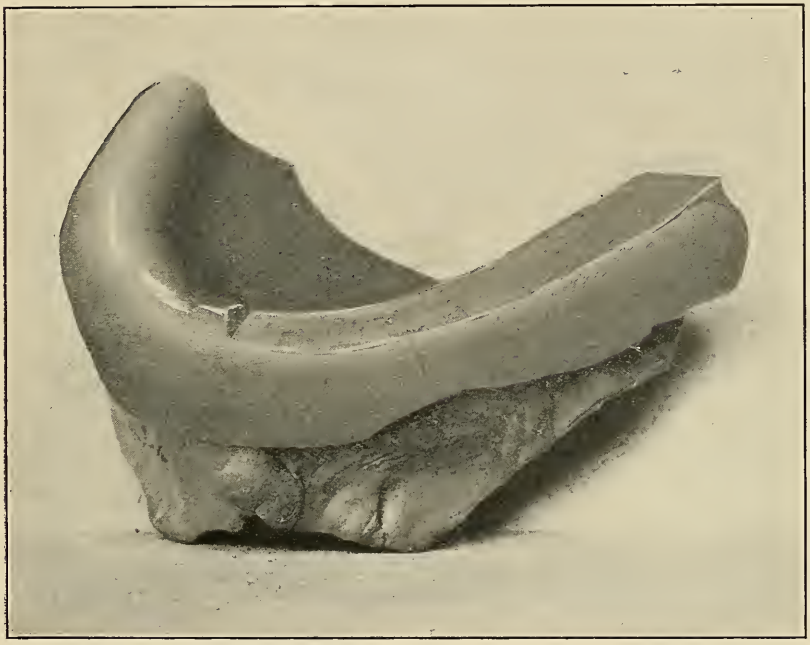
* The external opening of the canal to the middle ear.

heated on one side till the wax begins to run, when the softened side is doubled on itself. One side of the folded sheet is now heated in like manner and again folded on itself, forming a roll. The roll, still soft,

ILL. No. 14.—Occlusal planes of bites established parallel with line from lower margin of auditory meatus to lower margin of ala of nose. Blade of knife held between bites; handle projecting.

is aligned along the upper ridge and quickly and firmly attached with the aid of a hot spatula. The base plate, with the wax rim attached, will be referred to hereafter as the trial plate.

A silver table knife is now laid within reach of the right hand. While the wax ridge is yet soft, the trial plate is placed in the mouth and supported by the pressure of the fourth finger of the left hand in the vault. The blade of the table knife is laid along the ridge on the right side, from heel to median line, and supported firmly in position by the middle and forefingers of the left hand. With the right hand,



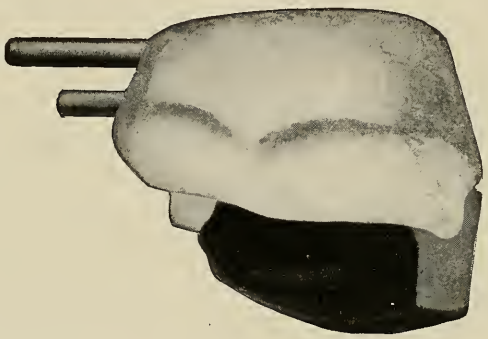
Ill. No. 15.—Upper trial plate (inverted) with the proper occlusal plane established on one side.

elevate or depress the projecting portion of the knife until it is seen to be *parallel with the line drawn on the face.* It is not expected that the knife will continue this line, since it is naturally below it, but that it will be parallel with it.

The pressure of the knife on the still soft wax of the ridge will flatten the occlusal surface, as in Illustration No. 15, and align it parallel with the line drawn on the face. To get this surface parallel with this line was the object sought when using the knife. This surface of this ridge will later be carved so that it will no longer be flat, but the accuracy of the future work will be greatly aided by getting this occlusal surface into the proper plane at this time. The trial plate should now be removed from the mouth and the occlusal surface of the

ridge on the left side trimmed to correspond with that on the right.

The upper trial plate, thus trimmed, is put back into the mouth, and the lips are brought together lightly in repose. This position of the lips is shown in Illustration No. 20. An instrument is now placed between the lips and a horizontal line is marked on the labial surface of the upper trial plate. This mark is known as the "rest line" from the resting position of the lips.* See Illustration No. 17. The trial



Ill. No. 16.—Section of an upper trial plate at the median line, trimmed labially and occlusally as required for the case in which it was used. Shows form of ridge.

plate is now removed from the mouth and a parallel horizontal line is made about 1½ millimeters (approximately one-sixteenth inch) below the rest line, and the wax is trimmed vertically to this mark. Care must be exercised to maintain the occlusal plane already established. Should the upper trial plate be shorter than would be indicated by the above measurements, it must be built down, maintaining the occlusal plane while so doing.

When experience makes it possible, it will be found practicable to press the knife-blade upward till the ridge is but little deeper than the upper lip is long. Very little vertical trimming will then be necessary.

The upper trial plate, trimmed to correct length, is left in the mouth,

* The lips are said to touch lightly in repose when it does not require effort to get them together, and when they do not touch so heavily as to be unduly turned out at the margins.

while a roll of wax is shaped and attached to the lower base in the same manner as was done to the upper. This is shaped to be deeper verti-

Ill. No. 17.—Marking the "rest line."

cally than the finished ridge will be. While the ridge is still soft, this lower trial plate is put into the mouth and the jaws closed together

until the lips lightly touch in repose. By a little practice, this may be successfully done, especially if the patient is not allowed to approximate

ILL. No. 18.—Edentulous patient seen from the side. The sinking of the lips as well as the vertical droop is here clearly seen, especially at the corner of the orifice of the mouth. (This picture and No. 20 were taken in the same light and at nearly the same time. They illustrate the necessity for and possibility of restoration.)

the jaws too rapidly. When the lips are in correct position the lower ridge will be of the right height and will have its occlusal surface in the proper plane.

The combined height of the trial plates will be found unevenly divided, the upper bite being much higher than the lower. This is be-

Ill. No. 19.—Edentulous patient showing drooping of soft tissues following extraction of teeth. The labial ends of the alæ and septum droop and the tissues in the labial triangle sink inward. (This picture and No. 21 were taken in the same light at the same time, and illustrate very clearly the possibilities in restoration.)

cause these plates are designed to fix the positions of the upper teeth rather than of the lowers. When the upper teeth are set, the lowers may be set to them, underbiting them in the anteriors, and interdigitating with them in the posteriors. In most natural dentures, nature ex-

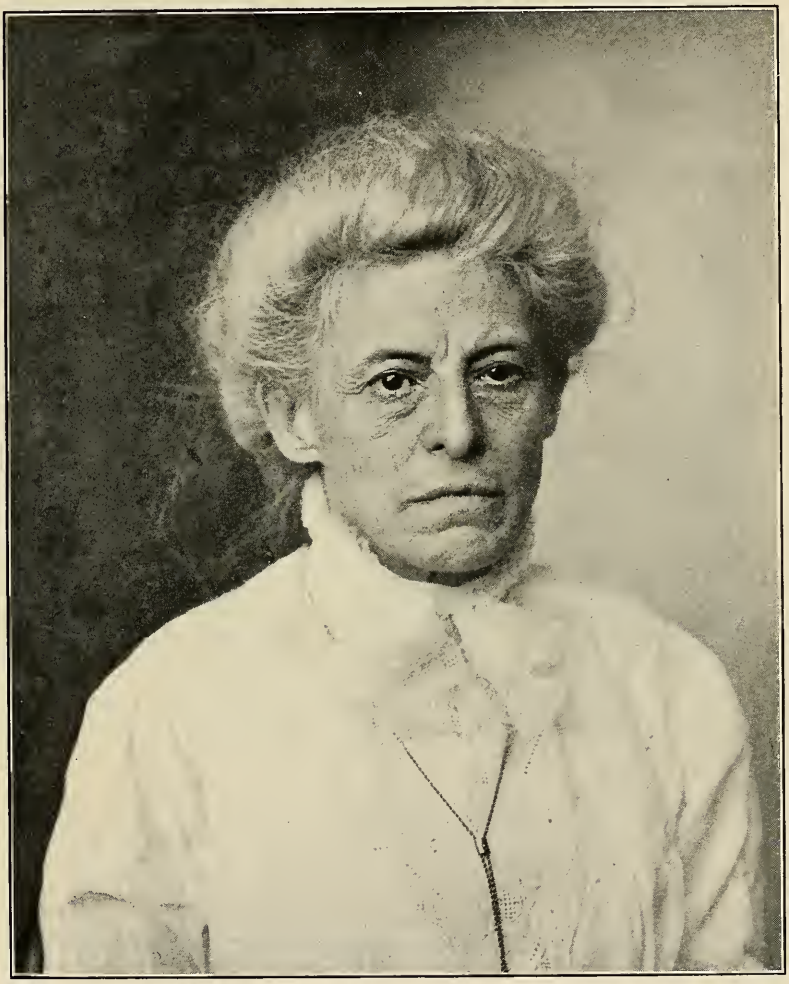
tends the upper centrals below the rest line. By doing so she enhances the beauty of the expression when the lips are slightly separated, as is common in periods of relaxation; and she maintains for the edge of

Ill. No. 20.—Patient with bites in position. The labial ends of the alæ and septum are pushed up to place, vivifying the expression. The lips are built out in harmony with the general facial contour. Note how much more animated and vigorous the expression is than in No. 17.

the lower lip, when the lips are closed, that outward turn which contributes so materially to facial expression and often to beauty. The fact that the lower trial plates are shorter than the lower teeth are to be,

need cause us no uneasiness, since it will be remedied when the lower teeth are set to underbite the uppers.

Now that the ridges are of correct heights, the trimming or building of the labial and buccal surfaces to give the desired facial expres-



Ill. No. 21.—Patient with trial plates properly built up and out as in Ill. No. 22. The tissues in the labial triangle, the alæ and septum, and the corners of the orifice of the mouth have been lifted by making the plate high over the cuspid eminence. Contrast the appearance here and in No. 19

sion may be done. While doing this trimming the dentist will have opportunity to exercise his artistic ability in restoring the expression of the face. Following the extraction of the upper cuspids, the outer

plate of the alveolus sinks and the soft tissues fall not only inward but downward. See Illustrations Nos. 18 and 19.

Much of the loss of habitual expression may be restored by lifting the tissues vertically.* The effect of such lifting on the expression of

Ill. No. 22.—Upper and lower trial plates with occlusal plane properly established and built out labially and buccally to give proper expression. The upper is as high over the cuspid eminence as can be worn and lifts the tissues, as in Illustrations Nos. 18 and 19.

any patient may be seen by placing a dull bladed instrument under the lip of an edentulous person and pressing upward. The facial ends of the septum and of the ala, together with the tissues which form what might be called "the labial triangle,"† may be lifted toward the eye. By this lifting, the "drooping" expression so common to edentulous faces may be largely done away, to the great advantage of the patient.‡ See Illustrations Nos. 20 and 21. If the upper base be trimmed high over the cuspid eminences and as high from these to the frenum as may

* This means vertically when the head is upright.

† That triangle formed by the ala of the nose and the line from the ala to the corner of the orifice of the mouth, and spreading into the lip below.

‡ The writer is glad to acknowledge his indebtedness to Dr. A. O. Hunt for instruction on this point.

be without dislodgment of the trial plate by the muscles, this lifting may be, at least in part, accomplished.

The distinction must be kept in mind between a high trial plate in this section and a thick one. A trial plate is high vertically; in this section it would be thin from jaw-bone to lip. It will be frequently necessary to carve the trial plate as thin in this section as the plate can safely be. The trial plates for the case here illustrated are shown in Illustration No. 22.

When making plates without anterior gums it will often be found advisable to have a horn of rubber reach forward from where the gums begin and lift the soft tissues over the cuspid eminence.

The guide as to the fullness of the lips and cheeks is found in the expression, and the trial plates should be built or carved as may be shown, by trial in the mouth, to most favorably affect that expression.

CHAPTER III

THE TRIAL PLATES AS GUIDES IN TOOTH SELECTION

While the most important function of the trial plates is, of course, to determine the relation of the jaws, their aid in the correct selection of the teeth is scarcely less important. This function of the trial plates seems to have been but little appreciated in the past and, so far as the writer knows, has never been properly developed.

A little consideration shows that both the mechanical and the artistic success of the plates are largely dependent on teeth of proper size and form being selected. There is no other guide to the selection of the proper teeth save correctly made and properly articulated trial plates. By means of them, the dimensions of the required teeth may be obtained with surprising ease, accuracy and rapidity, once the very simple technic is mastered.

Do not think such selection is opposed to the exercise of taste and art in the choice of teeth. Most assuredly it is not. Such selection assists art in a most valuable manner. Art in tooth selection deals first with the form and color of the teeth and later with their arrangement. It is practically impossible to determine by the precepts of art alone the exact dimensions of the teeth required for a denture. But mechanics will give the exact dimensions very quickly and very accurately; and art, using these dimensions as the beginning of its work, determines the outline of the teeth and their shade.

Art need have no hesitation in availing herself of the services of her humble and necessary handmaid—Mechanics, for if Mechanics build the foundation, Art rears the superstructure and beautifies it. As it avails little to beautify a superstructure which stands awry, so art in

plate work, without a foundation of sound mechanics, avails little. Of what use are artistic plates that will not masticate?

Upon the trial plates thus properly carved for height and fullness, we have now to record the dimensions of the teeth indicated for the case in hand. This may be easily done by observing the rather constant relations between the positions of the lips and the sizes of the

Ill. No. 23.—The incisal edges of the upper centrals normally project about 1½ mm. below the rest line of lips. Cardboard placed between lips at rest. Lips opened. Location of rest line on natural centrals shown by end of cardboard.

natural teeth in the majority of normal mouths. Even were no such relations observable, the following method would still greatly aid in obtaining artistically pleasing results with a minimum expenditure of time and labor.

It has been noted that about three persons out of four, when smiling unobserved, raise the upper lip until its edge is on a level with the

necks of the natural centrals. The effect thus produced is very pleasing, much more so than in those cases where the lip is not raised to the necks of the teeth or is raised much above them. Profiting by this observation, we may have the patient raise the lip by the use of the elevator muscles about as we think it would be raised in smiling, and

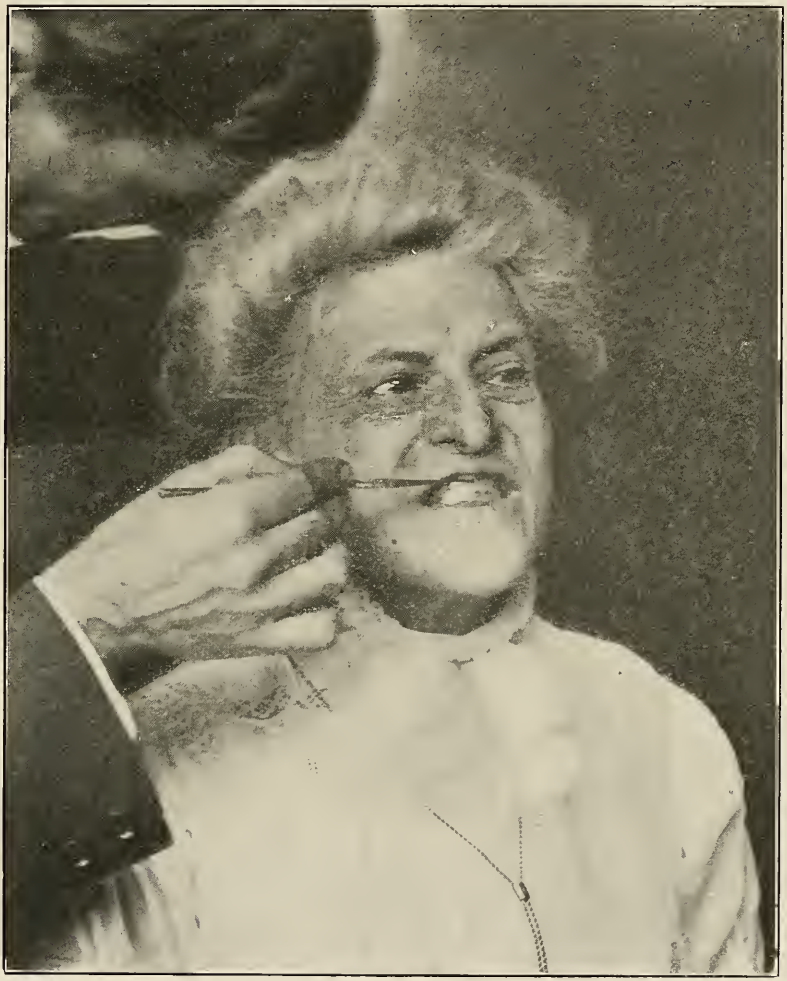
ILL. No. 24.—Three people in four, when smiling unobserved, raise lips to level of necks of natural centrals. A hearty laugh usually elevates the lip still further.

make on the labial surface of the upper trial plate a horizontal mark at the edge of the lip, as in Illustration No. 25. The lip should not be raised to the degree of a hearty laugh.

The line thus obtained is known as the "high line," and may sug-

gest to us the proper location for the necks of the artificial centrals. The distance between this line and the labio-incisal angle of the wax ridge is the length of the artificial centrals, save for the collars which are embedded in the vulcanite.

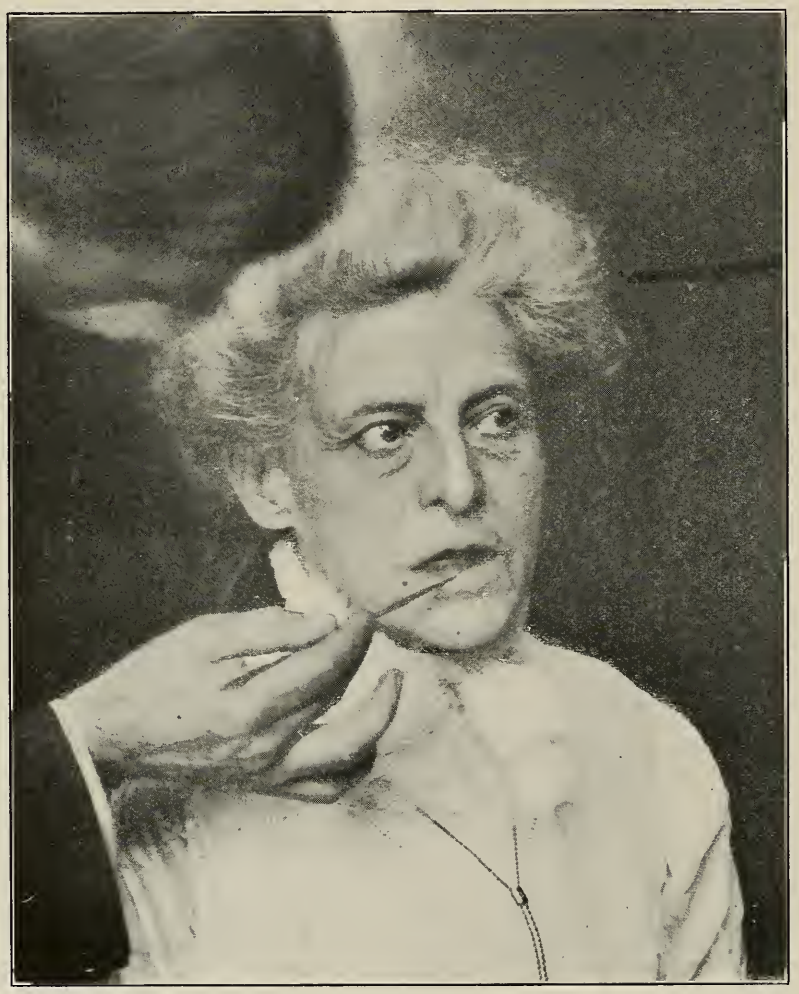
Should the length thus indicated be obviously too great or too short for esthetic results, it can be modified at will; but experience suggests



Ill. No. 25.—Marking the "high line."

that in the average case it should be modified only after careful consideration. If artificial centrals of this length be selected, the denture, when exposed in smiling, will exhibit a maximum of porcelain

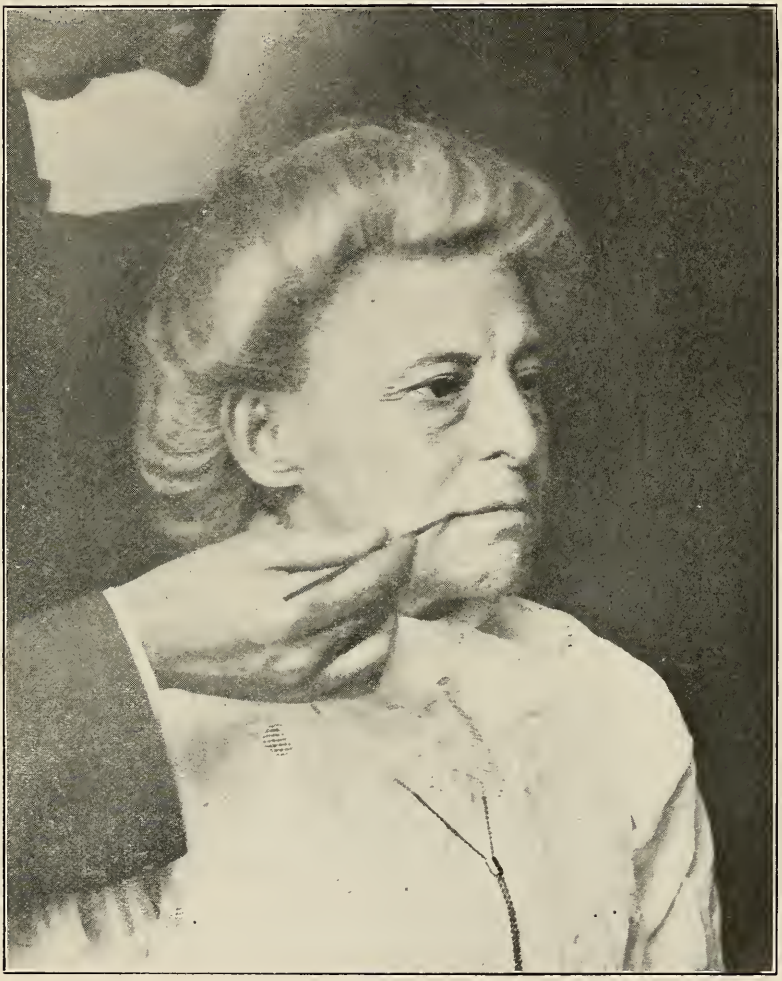
and a minimum of vulcanite. So desirable an end is this that better results are obtained by selecting upper anteriors as nearly of this length as possible, even though they be slightly longer than the contour of the face might indicate. The exercise of a little art in their arrangement will partly conceal their length; and the exhibition of vulcanite should be avoided when possible.



Ill. No. 26.—Marking the "low line."

To prevent the exhibition of the vulcanite of the lower denture when smiling or talking, the patient should depress the lower lip by the use of the depressor muscles, and a "low line" is marked on the lower bite, as in Illustration No. 26. The lower lip is frequently depressed

in laughing, or by movements peculiar to the person. If the necks of the lower centrals be located at the low line, little vulcanite will be exhibited. This line is subject to change at will, but the considerations



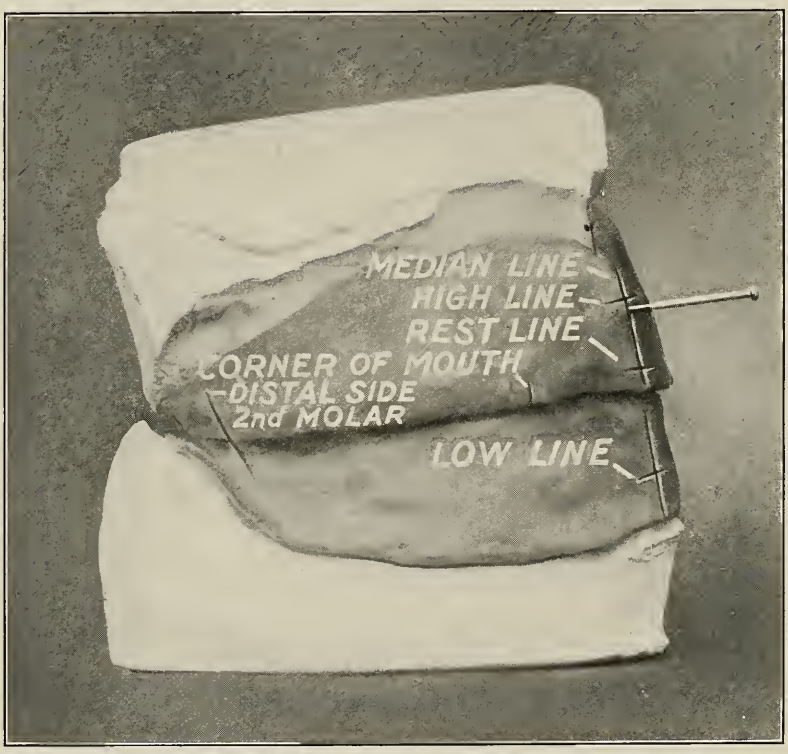
Ill. No. 27.—Marking the location of the corners of the orifice on the upper bite.

which govern the location of the high line apply here with equal force.

Having determined the length of the anteriors, let us decide on the width of the six anteriors taken as a whole. In cases where the orifice of the mouth is neither noticeably large nor small as proportioned to

the size of the face, pleasing esthetic results may be realized by selecting upper anteriors of such combined width as will bring the distal angles of the cuspids at the corners of the orifice of the mouth when at rest.

To register on the bite the width of the orifice, place an instrument between the lips at the median line, move it gently to one corner of the orifice and make a vertical mark on the upper bite, and then, with-



Ill. No. 28.—Wax bites showing marks which determine the sizes of teeth required.

out disturbing the lips, slide it between them to the other corner and make a similar mark. See Illustration No. 27. This method gives better results than inserting the instrument near the corners of the orifice, which tends to cause the patient to pull the corner back to avoid the instrument, and thus enlarge the orifice.

This dimension is subject to the same modification at the dentist's

discretion as the length of the anteriors. In some cases the orifice is large in proportion to the face. In such cases the anteriors should not be as wide as the orifice. In some cases the orifice is small; the anteriors may then be somewhat wider. In cases where the ridge is pointed at the median line, "squirrel mouthed," as it is sometimes called, the anteriors will be so prominent that they must be considerably narrower than the distance around the ridge from one corner of the orifice to the other.*

After the trial plates have been removed from the mouth, they should be examined and the approximation of the ridges in the molar region noted. A point should be selected where the distal surface of the upper second molar is to come, and a vertical mark made opposite that point on the buccal surface of the wax as shown in Illustration No. 28. A similar mark is then made on the buccal surface of the opposite side.

When these marks have been made, the trial plates may be removed from the mouth, the marks deepened, and a little black wax, such as teeth come on, may be run into each mark. This will locate them definitely and will preserve them during subsequent handling.

The trial plates may now be returned to the mouth and a final decision reached as to the correctness of location of the blackened marks, especially as regards the width of the six anteriors. If anteriors as wide as between the marks would be noticeably wide for that face, the marks may be brought together until the width would appear about normal. A second guide as to the location of the marks will be found in their relations to the cuspid eminence. If the marks are far distal to these eminences their position will doubtless require modification.

In cases where no other guide serves to indicate the proper location of these marks, they may well be placed just a little distally of a perpendicular line passing beside the wing of the nose. Observation of the relations between the wings of the nose and the natural cuspids will quickly inform a dentist as to this relation.

These modifications should not lead anyone to underestimate the value of these marks. Rightly used, they will be found of the greatest value and help.

* A case of this kind was recently submitted in which it was necessary to place the distal angles of the first bicuspids at the corners of the orifice.

CHAPTER IV

AN IMPORTANT DIMENSION IN ARTIFICIAL TEETH

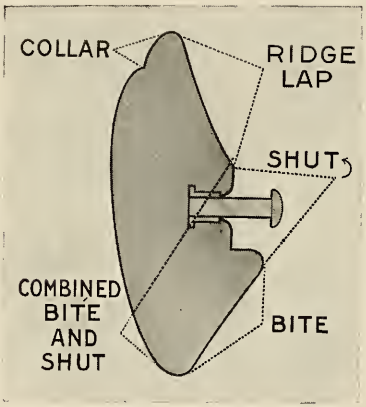
How shall we select teeth that will sit in right relations to the ridge without the need of grinding? This is one of the most difficult questions the plate worker has to settle. The necessity for accurate selection explains why, in almost every dental depôt, one sees dentists trying teeth on models. This is the slowest, most inaccurate and most expensive form of tooth selection, but is made necessary by the fact that most dentists do not know how to select a mould of teeth that will sit in right relations to the ridge, and bring the cutting edge and neck in the right locations. Since it is with artificial teeth we are to work, let us study them for a little and learn their possibilities that we may select them intelligently.

An artificial upper central presents two surfaces which are important for widely different reasons. Note first the labial surface. It is the art surface of the tooth, "the patient's surface," we might call it. Its length from neck to cutting edge, its width from side to side, its outline and the bulge of the labial surface are important as to whether or not they harmonize with the patient's face. This is the surface of the tooth which the patient sees; it largely determines the appearance of the finished plate. It has very little to do with the mechanical side of plate making or with the patient's success in masticating with the plate.

But the other surface of the tooth, the overlooked, neglected, little-understood lingual surface, is especially and wholly the dentist's surface. It is the surface whose divisions determine the mechanical fitness of any tooth for the case. It is with this surface that dentists have

unconsciously wrestled in the past. This surface, properly understood and utilized, will do much to make the mechanical side of plate work easy. It is this surface, also, which largely affects the patient's success in mastication and clearness of enunciation.

The lingual surface of an anterior tooth shows three divisions. The first begins at the cutting edge and extends cervically to a pronounced ledge; this portion of the tooth is known as "the bite," because it is engaged in biting food by contact with the opposing teeth. The next division presents a flat surface from which the pins project. It is known as "the shut." The third portion extends from "the shut" to the cervical end of the tooth; it is known as "the ridgelap," because it is the only part of the tooth which should lap the ridge.



Ill. No. 29.—Diagrammatic illustration of the divisions of lingual surface of an upper central. An understanding of the uses of these divisions greatly simplifies artificial tooth selection.

Dentists have been accustomed to consider these divisions of the lingual surface separately. They have attached much importance to the bite, have practically ignored the shut, and have selected the ridge-lap because it was thick or thin linguo-labially. This is not the form of consideration which brings best results.

The divisions of the lingual surface of an artificial tooth fall naturally into two groups, according to their functions. The *bite and shut together* form one group because their combined length should carry the incisal edge of the tooth from the surface of the gum to the labio-incisal angle of the wax ridge of the trial plate. Note that it is not the

bite of the artificial tooth alone which carries the tooth down; it is the combined bite and shut. Learning first to group these two divisions to meet this requirement will greatly aid any plate worker in tooth selection. The remaining division of the lingual surface, the ridgelap, stands alone as to function, It is intended to lap the gum, and to carry the neck of the tooth up to the high line. If the tooth has a collar, it is supposed to be covered with vulcanite, as a lock to aid in supporting the tooth against stress.

The manufacturer supposes that the dentist will select a mould of teeth in which only the ridgelap will rest against the alveolar ridge, and the bite and shut will come below it in an upper, or above it in a lower. To facilitate such selection he offers teeth of the same length and width, with the divisions of the lingual surface in different proportions. For instance, Illustration No. 30 shows four upper centrals which are of precisely the same length,* but in which the divisions of the lingual sur-

Mould 4.
Length 10 mm.
Combined bite and shut 4½ mm.
Bite 2 mm.

Mould 11.
Length 10 mm.
Combined bite and shut 6 mm.
Bite 2½ mm.

Mould 13.
Length 10 mm.
Combined bite and shut 7 mm.
Bite 3 mm.

Mould 14.
Length 10 mm
Combined bite and shut 7½ mm.
Bite 3½ mm.

Ill. No. 30.

face differ greatly. Not only are these centrals of the same length and width, but the six anterior teeth in each of these moulds are of the same combined width, so that, but for differences in the *outlines* of the teeth, plates made from these four moulds appear much alike when seen from the labial surface. But when the teeth are examined from the lingual surfaces, it is seen that hardly any two of them are mechanically suited for the same case.

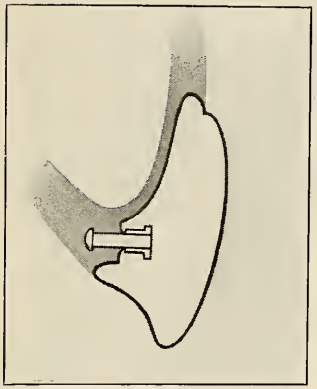
This can be best seen by studying Illustration No. 31, in which, by a diagram, each mould is shown in section on a case for which it is mechanically adapted.

Illustration No. 31 supposes that each of these moulds has been properly selected for the case. By properly selected is meant that the cutting edges of the centrals come to the labio-incisal angle of the trial

* Twentieth Century Moulds 4, 11, 13, 14.

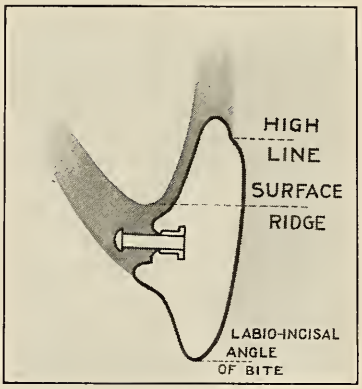
plate, the necks come to the high line, and the bite and shut sit properly below the ridge.

In Illustration No. 31*A*, the distance between the ridge and the labio-incisal angle of the bite is short. A tooth having a short *combined*



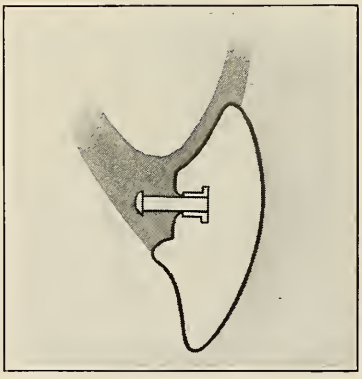
31*A*.

Little absorption. Distance from surface of ridge to labio-incisal angle of bite is short. Requires tooth with short combined bite and shut.



31*B*.

Great absorption. Chance to use tooth with longer bite and shut than in 31*A*.



31*C*.

Complete absorption. Distance from surface of ridge to labio-incisal angle of bite permits use of tooth with long combined bite and shut.

Ill. No. 31.

bite and shut must be selected if it is to set properly against the ridge. Many dentists have given much attention to the length of the bite, entirely overlooking the shut. Here is where they fail. *It is not the length of bite alone that determines the mechanical fitness of a mould; it is the length of the combined bite and shut.* If these, taken together,

are not too great, the length of bite may be nearly as desired. Note that the mould chosen for this case has a short combined bite and shut, 4½ millimeters, but the total length of the tooth is such as to meet the artistic requirements of the case. A properly divided lingual surface takes care at once of the *mechanical* fitness of the mould.

In Illustration No. 31*B*, the distance from the surface of the alveolar ridge to the labio-incisal angle of the trial plate is greater, permitting the use of a tooth with a longer combined bite and shut.

In Illustration No. 31*C*, absorption of the alveolar process is practically complete. The distance from the surface of the alveolar ridge to the labio-incisal angle of the trial plate is great; and a tooth having a long combined bite and shut should be used. The tooth here illustrated has a moderately long bite, but the bite might have been either shorter or longer, so long as the *combined bite and shut* were of the proper length.

Ill. No. 32.—Vertical section of Mould No. 14, in solid line, contrasted with outline of Mould No. 4, in dotted line. Shows the disadvantages of using moulds with short combined bite and shut when a long combined bite and shut is indicated.

It is evident that Mould 4, shown in Illustration No. 31*A*, would go below the ridge in Illustration No. 31*C* without grinding, but the following reasons will convince the careful plate worker that it should not.

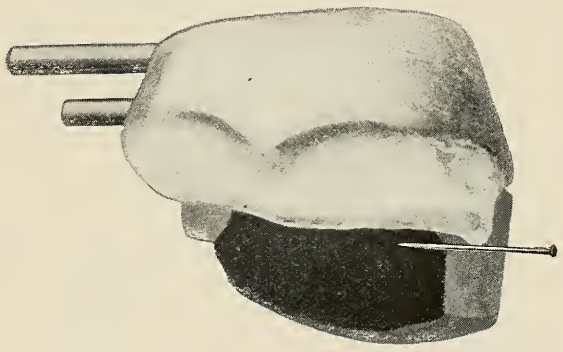
First. If the mould in Illustration No. 31*A* be set below the ridge in Illustration No. 31*C*, it will come where the dotted line in Illustration No. 32 comes. This necessitates much thicker rubber over the alveolar ridge and makes the plate more heating to the tissues, and more likely to vulcanize porously.

Second. Mould 14 in Illustration No. 31*C* has a long bite. It simulates closely the natural teeth as to thinness in the middle and incisal thirds. It makes an agreeable place for the tongue in articulation.

If Mould 4 be used, it extends lingually as does the dotted outline in Illustration No. 32, and makes an awkward place for the patient's tongue in speech and mastication.

Third. The bite of Mould 14 has much greater cutting power than that in Mould 4. It *cuts* through food where Mould 4 crushes through. Plates made with anteriors having at least medium long bites (a medium bite is 3 millimeters long) are much less likely to be thrown down behind in the act of biting. It is therefore advisable to use teeth with medium long bites whenever the required length of combined bite and shut makes it possible, save, of course, in end-to-end-bite cases.

Selecting teeth with proper bites is very easily done, once the proper length of the *combined bite and shut* has been determined. It is neces-



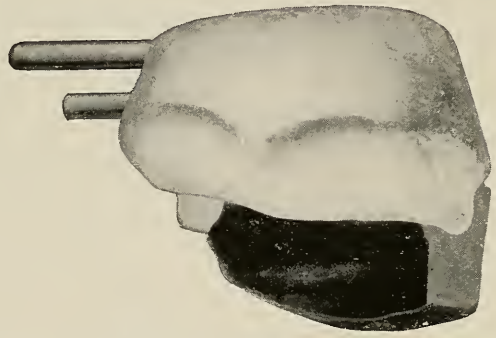
Ill. No. 33.—Section of trial plate in median line showing pin as thrust through wax ridge in proper location and direction.

sary only to decide how much of that distance shall be in the bite. Suppose that the distance from the surface of the alveolar ridge to the labio-incisal angle of the trial plate is 7½ millimeters, the combined bite and shut of the required artificial central should not be greater than that distance. We may now decide that our bite shall be short (2 to 3 millimeters) or medium (3 to 3½ millimeters) or long (over 3½ millimeters). We may thus decide, before we look at a tooth, what general form it shall have. The method of applying this information, which we shall soon study, is very simple.

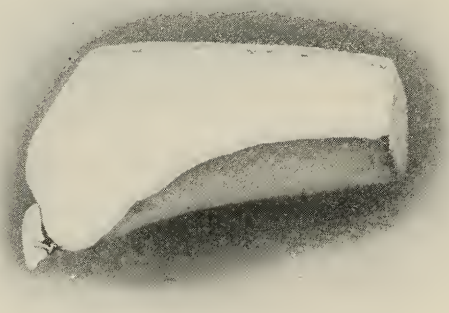
Having learned that the bite and shut of an artificial central should sit between the surface of the ridge and the labio-incisal angle of the

bite, it remains only for us to learn how great that distance is in the case for which we are selecting teeth, and then choose a mould of tooth having a combined bite and shut equal to the distance.

The distance between the surface of the ridge and the labio-incisal angle of the bite is easily learned. Hold the trial plate so that the



Ill. No. 34.—Model showing thin ridge. In such a case a combined bite and shut not greater than from pin-hole down is indicated.



Ill. No. 35.—Section of model showing ridge thick linguo-labially. In such a case, a bite and shut slightly longer than from pin-hole down may be used.

palatal surface can be seen where it presses against the alveolar ridge in the median line. Thrust a pin horizontally backward from the labial surface of the trial plate, in the median line, at such level that it pierces the wax just level with the surface of the alveolar ridge. See Illustration No. 33.

The pin-hole locates the level of the surface of the alveolar ridge on the labial surface of the wax. The distance from the pin-hole to the

labio-incisal angle of the wax is the space available for the bite and shut of the central.

If a central of proper length and having a combined bite and shut nearly equal to the distance from the pin-hole to the labio-incisal angle of the trial plate, be properly set against the alveolar ridge, the neck will come at the high line on the wax, and the cutting edge at the labio-incisal angle.

There is one exception to be noted in obtaining this dimension, and, properly observed, it will greatly aid us in selecting teeth for close-bite cases, because it affords a wider range of moulds to select from. This exception obtains only in cases where the ridge is thick linguo-labially. It can be best understood by repeating an illustration and studying it from a new viewpoint.

In Illustration No. 34 the ridge is thin linguo-labially, The pins of the artificial tooth will extend across it; they will come on the lowest part of its surface. Therefore, in this case, all that has been said above about the combined bite and shut not being greater than from the lowest point of the ridge to the labio-incisal angle of the trial plate applies exactly. But in Illustration No. 35 is shown a section of a very different type of alveolar ridge. This ridge is thick linguo-labially. When the teeth are set as they would be in most cases (the labial surface of the built-up wax ridge will show how they are to set for any given case), the teeth cannot reach far enough under the ridge to bring the bite and shut below *the lowest point,* but they will come anterior to and a little above that point. Therefore, when the ridge is thick linguo-labially and the teeth are to set slightly forward of the ridge instead of against it, the combined bite and shut may be at least a millimeter greater than the distance between the pin-hole and the labio-incisal angle. And the teeth will still go to place without grinding.

CHAPTER V

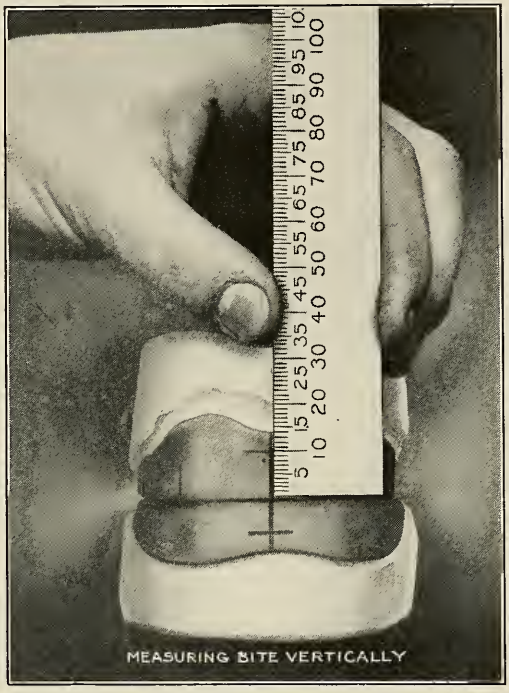
GETTING THE EXACT DIMENSIONS OF THE REQUIRED ARTIFICIAL TEETH

The only appliance needed for getting the dimensions of the required teeth is a flexible millimeter measure. On a foot-rule there is usually no division less than 1-16 of an inch, and this is too large a dimension for measuring teeth. After long study the writer adopted a millimeter as the most convenient unit of measurement. The millimeter measure should be flexible, so that it may be bent about the bite. There is outside evidence that the use of the millimeter was wise, because, soon after the writer brought out the method here outlined, he received a letter from a Southern dentist saying that he had devised a similar method of measuring teeth several years before. He had no doubt this method was based on his; in this he was in error, since the writer knew of no similar method.

With the millimeter measure, get the distances in millimeters between the marks on the trial plate; turn to tables where artificial teeth are described in millimeters, and select the mould of teeth most nearly conforming to the requirements. Note the number of the mould and order by that number. That is all there is to this method. It saves time and errors every time it is intelligently used.

The first step is to get the length of upper centrals. To do this, measure between the high line and the labio-incisal angle of the upper trial plate. This does not give the full length of central; it gives the length of the labial surface, the part that is to show; above this part of the tooth must be a collar that extends into the vulcanite, when there are to be rubber gums in front. Some moulds of artificial teeth do not have collars, but the neck of the tooth itself then extends into the rubber.

The artificial central should be at least a millimeter longer than the distance from the high line to the labio-incisal angle. On the trial plate here measured, the distance from the high line to the labio-incisal angle is 9½ millimeters; adding 1 millimeter for the part of the tooth to enter the rubber, indicates a length of 10½ millimeters for the required central.



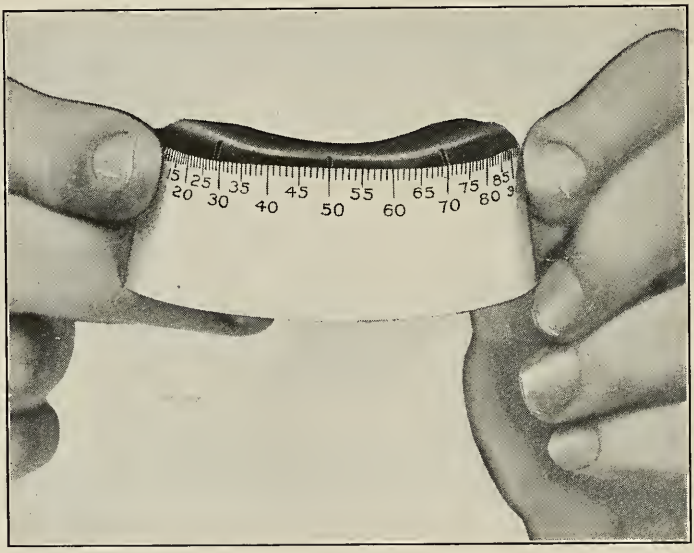
Ill. No. 36.

A millimeter is equal, for all practical purposes, to 1-25 of an inch. It is evident, therefore, that a variation of ½ a millimeter either way in the length of the central will make no serious difference. It may, therefore, be decided that the central should be from 10½ to 11 millimeters long. This gives a wider range of moulds from which to select to meet the other requirements. This dimension, "Length of central, 10½ mm.," should be noted.

The distance between the pin-hole and the labio-incisal angle of the upper trial plate indicates the proper length of the combined bite and shut of the artificial central. If the ridge is thin linguo-labially and the teeth are to set close to it, this dimension should not be increased. But

if the teeth are to set well away from the ridge, or the ridge is thick linguo-labially, this dimension may be increased a millimeter, as has been explained. The distance from the pin-hole to the labio-incisal angle of this trial plate is 7½ millimeters. The combined bite and shut of the central then should not be greater than 7½ millimeters. If the bite and shut are correct in the central, they will probably be so in the other teeth of the set.

Get next the width of the six anteriors taken together. This is more important, for the present, than the width of the central alone, since the anteriors as a whole strike the eye first when the plate is seen. Measure



Ill. No. 37.—Measuring bite horizontally to get combined width of six anteriors and full set of 14.

between the vertical marks made at the corners of the mouth. This is the distance from the distal angle of one upper cuspid to the distal angle of the other *when the teeth are set up.* This is quite different from the distance between these angles as these teeth lie flat on the wax on which they are sold. This point should be borne in mind. The third requirement then is " Combined width six anteriors, 43 millimeters."

To get the width of the full set of 14 teeth when set up, measure between the marks made to locate the distal side of the upper molars. Do this by bending the rule close about the outside of the upper trial

plate at the incisal angle. Suppose this distance to be 101 millimeters. As in the case of the anteriors, this dimension is quite different from the width of the teeth as they lie flat on the wax on which they come from the dealer.

When this dimension has been noted the requirements are as follows:

Length upper central, 10½ mm.

Combined bite and shut, not over 7½ mm.

Combined width 6 anteriors, 43 mm.

Combined width full 14, 101 mm.

These dimensions are much more valuable for selection than mere sight of the teeth could be. It is well known that the sight of many teeth confuses the one who is selecting. The eye does not perceive actual dimensions—it sees only proportions. A certain mould may "look about right," when really not a single dimension fits the requirements. Having in hand the actual dimensions of the required teeth will help us wonderfully.

The dimensions of the lower teeth may be easily gotten if desired. But the anatomical moulds are furnished in sets of 28, that is, full uppers and lowers. The lower anteriors have been carefully selected to harmonize in character with the uppers and to be of proper widths for articulation. It will generally be found satisfactory to select the uppers to meet the requirements and to use the lowers carded with them. If, however, it is desired to get the dimensions of the lowers, proceed as follows. To get the length of central, measure from the low line to the rest line. The lower anteriors underbite the upper anteriors and should extend as high as the rest line. Add 1 millimeter for collar, making the length of the desired central 11 millimeters. A pin is thrust through the lower trial plate to locate the surface of the alveolar ridge in the same way that the surface of the upper alveolar ridge was located. Measure for the combined bite and shut as on the uppers. The distance in this case is 8 millimeters. The requirements for the lower centra are as follows:

Length, 11 mm.

Combined bite and shut, not over 8 mm.

If lowers other than those carded with the uppers are desired to articulate with uppers, being made at the same time, or if the lowers are selected for a lower plate which is being made alone, the width of the 6 anteriors and the full 14 must be gotten also.

Having the dimensions of the required teeth, either of three methods of selection may be followed. The first is to measure artificial teeth a

they lie on the wax. The only dimensions which come right by this method are the length of the centrals and the combined bite and shut. The widths of the anteriors and of the full set will not be right. The second course is to measure pictures of artificial teeth as they appear in catalogues. This is subject to the same errors as the first course, with a few additional errors due to engravings not always being exact. The only other course is to have access to tables where the dimensions of artificial teeth in millimeters are given to meet such requirements. Only one tooth manufacturer has so far published such tables of moulds, and from those tables selection will be made.* The dimensions here given are not exact, because teeth vary a trifle in shrinkage during baking, but they are very close. Thus, the combined width of six anteriors may vary a millimeter or so either way from the dimensions given here, but even with this variation the accuracy is greater than is obtainable by any other method.

Great care was taken to get these dimensions correct. After repeated measurings of the teeth, a Bonwill circle was cut in cardboard for each mould and the teeth set to it on wax. They were then measured, and the dimensions here given were verified. There may still be slight errors in the dimensions, but almost endless pains were taken to have them correct.

The requirements for upper teeth are as follows:

Length, 10½ to 11 mm.

Combined bite and shut, not over 7½ mm., but as near it as possible.

Combined width 6 anteriors, 43 mm.

Width full set of 14, 101 mm.

Page No. 49 of this book shows a portion of the table giving the dimensions of the plain vulcanite teeth, uppers arranged in order by size. The first column gives the mould numbers; each mould is described by the figures in the remainder of its line. This column is important, because when teeth of proper size are found they should be ordered by the mould number.

The next column gives the length of the central in the mould. This is the column used first, since the length of central is the most convenient dimension with which to begin.

The third column gives the combined width of the six anteriors when set up. This dimension corresponds to the distance between the

* The Dentists' Supply Company in the Twentieth Century Mould Book. The writer spent nearly a year working out the methods here described and their application in the forms of tables. The publishers of this book spent $15,000.00 in presenting this information, as applied to their products, to the profession.

marks at the corners of the mouth. The use of this column next, permits much more rapid selection than any consideration of the width of

MEDIUM LONG MOULDS.

(ALL DIMENSIONS ARE IN MILLIMETERS.)

Mould No.	Length of Central	Approx. width 6 anteriors set on Bonwill Circle	Approx. width full 14 set on Bonwill Circle	Combined Bite and Shut of central	Bite of Central	Width of Central	Articulates with lower moulds	Cut and description or page
			MEDIUM LONG AND NARROW.					
4	10	43	103	4½	2	7	3-21-9-65	29
11	10	43	102	5½	2½	7	7-2-10	30
14	10	43	105	7½	3½	7	a14-2-3-8-70	30
16	10	42	99	4½	2	7	24-7-27	30
31	10	42	103	5	2	6⅔	7-2-70	30
41	10	43	103	5½	2½	7	7-8-2-10	31
89	10	42	98	7	3½	7	8-2-3-10	31
67	10	40	100	6½	2½	6⅔	67-7-2	31
37	10½	43	104	7	3	7	a37-3-2-8-70	31
19	10½	43	104	6	3	7	a19-7-24-2-8	32
30	10½	42	100	7	3	7	a30-3-2-7-17	32
90	10½	42	100	7½	4	7	90	32
27	10½	40	101	8½	4	6½	25-7	32
51	11	42	102	7½	3	7	51-11-3	33
91	11	42	99	5½	2	6¾	91-2-7	33
			MEDIUM LONG AND MEDIUM WIDE.					
13	10	43	107	7	3	7⅓	65-3-21-5	33
20	10	44	106	6½	3	7⅓	53-1-5-24	34
88	10	45	108	6½	3½	7⅓	9-3-2-24-70	34
5	10	44	105	6½	3	7½	a5-2-3-21-53	34
6	10	45	106	5½	2½	7½	a6-3-21-53-9-8	34
72	10	47	115	6½	3	7½	72-73-43	35
23	10	45	109	6	2½	7¾	40-5-65	35
7	10½	45	110	7½	4	7½	1-5-92	35
24	10½	43	108	7½	3½	7	1	35
2	10½	45	104	6½	3⅔	7½	3-8-2-10	35
35	10½	45	106	7½	4	7⅔	a35-65-5	36
79	10½	45	108	7½	4	7⅔	79-5-6	36
39	10⅔	43	103	7	2⅔	7½	8-2-10-7	36
25	10⅔	44	107	6½	3	7⅔	5-3-65-16-53	36
92	10⅔	45	110	7½	4	7⅔	92-5-103	37
9	10⅔	45	107	7½	4	7⅔	6-5-40-79-92	37
40	11	44	105	7½	4½	7	8-2-3-7	37
28	11	45	106	5½	2	7½	65-16-3-11	37
29	11	45	109	7	3⅔	7½	1-16-5-103	38
63	11	44	103	5½	2⅓	7½	8-7-10	38
65	11	45	106	6½	3	7½	65-3-11-21	38
12	11	46	106	6½	3½	7⅔	5-6-16-79	38
46	11¼	44	105	9½	3½	7½	3-5-11-16	39
66	11⅓	45	114	8½	3½	7¼	66	39
103	11½	47	114	9	4	7¾	103-92	39
			MEDIUM LONG AND WIDE.					
75	9⅔	50	116	6½	3	9½	75-69-19	39
47	10½	46	110	6	2⅔	8	6-5-28-79-40	40

Portion of table showing measurements of plain vulcanite teeth.

the central at this time. There are usually several moulds having anteriors of approximately the desired width.

The fourth column gives the width of the full set of 14 teeth, set up.

This dimension corresponds to the distance between the marks for the distal sides of the second molars.

The next column gives the combined bite and shut of the central incisor. This measurement corresponds to the distance between the pinhole and the labio-incisal angle of the upper trial plate. Taken with the three columns just preceding, it completes the most important dimensions of the teeth.

When the combined bite and shut have been found, the length of bite and the width of the central will help in making the selection more exact. These dimensions are given in the next two columns.

Ill. No. 38.—Patient for whom uppers and lowers were selected in 5 minutes after bites were marked. The upper anteriors just cover the area of plate exposed in smiling. The lowers for the same case are shown in the next illustration.

As evidences of the results easily attainable by this method of selection, a few photographs of patients are here exhibited, with the teeth in position.

The usefulness of the wide column headed "Articulates with Lower Moulds" has been greatly lessened by improvements in the moulds and carding of artificial teeth since this book was published. It will generally be found most advisable to use the teeth as they now come carded and the figures in this column may be disregarded.

The last column gives the page of the book on which each mould in the table is illustrated and described.

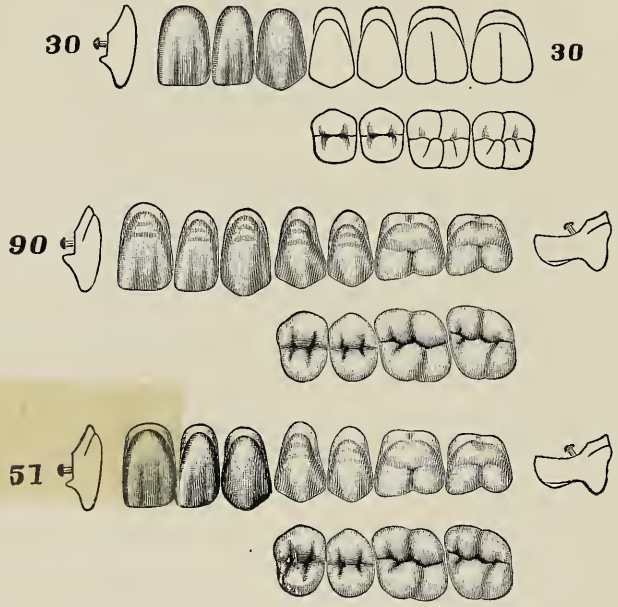
Ill. No. 39.—Lowers in the case shown on the preceding page. When the lower lip is depressed, the festoons about the anteriors are barely exposed. The only rubber shown is that in the interproximal spaces.

All the moulds in the table are divided into three groups: "Narrow," "Medium Wide" and "Wide." This is to further facilitate selection. Only two divisions of the table of "Medium Long Moulds" are reproduced here because of lack of space.

Now that we understand the table, let us select a mould to meet the requirements. A central 10½ to 11 millimeters long is required. In the "Medium Long and Narrow" section of the table seven moulds of the desired length are listed. Mould 37, the first of these, is of the correct width in the anteriors, but too wide in the full 14. Mould 19 is too wide in the anteriors. Mould 30 is of the desired dimensions

throughout; the same is true of Mould 90. Mould 27 has the proper length of central, but is narrow in the anteriors and too long in the bite and shut. If the central from Mould 51 is properly set against the ridge, the cutting edge will come at the labio-incisal angle of the trial plate, the neck at the high line, the distal angles of the cuspids at the corners of the mouth and the distal sides of the second molars at the marks made for them.

Mould 51 is correct in all its dimensions. This gives three moulds to choose from, 30, 90 and 51. The choice among these moulds must be decided by their artistic suitability for the case. By turning to pages 32 and 33 of the book here in use,* the illustrations show the outlines of the anteriors to be as reproduced here.



Ill. No. 40.—The character of these moulds may be determined from this illustration.

By referring to Illustration No. 21, page 25 of this book, the outline of the patient's face may be seen in part. But it is there shown at a little more than full face and seems rounder than it really is.

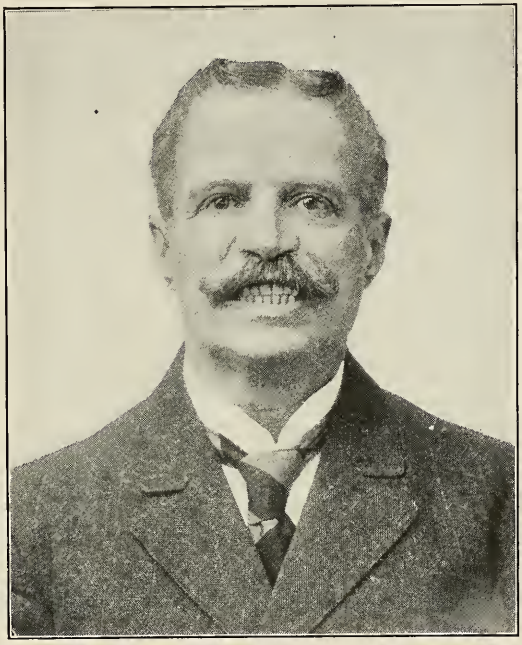
While the outline of Mould 30 would be fairly satisfactory for this face, the writer thinks it not equal to one of the others, partly on account of the long narrow lateral.

The outline of Mould 90 is not suitable. The central of this mould

* The Twentieth Century Mould Book.

shows much flatter curves in the middle and cervical thirds than are manifested in the lower part of this patient's face.

Mould 51 is more pleasing than either of the other two, partly because the outline harmonizes with the outline of the patient's face, and partly because it is a lap-lateral mould. By "lap-lateral" is meant that the laterals are so made that they may be set to lap the centrals if necessary.



Ill. No. 41.—The anteriors, both uppers and lowers, are of correct lengths to prevent pink rubber gums showing in smiling. It is believed that the teeth harmonize with the face in length, width and outline. Time required to select uppers and lowers after bites were marked, 5 minutes.

The irregularities which may thus be produced very greatly increase the artistic value of the denture.

Having determined what mould is desirable for the case, it should be ordered by mould number. The order for this case reads:

Send me 1 x 28 ——— ——— teeth.

Upper Mould 51, with appropriate lower, shade 10.

The selection of artificial teeth should not be left to the tooth clerks.

That is a manifest absurdity. The tooth clerk never sees the patient. He is usually furnished such meagre information as would preclude satisfactory selection by any one; and he is not expected to be a practical plate worker. Tooth selection has been left to him because dentists in general have not been sufficiently well informed to make their own selections. The dentist who knows every detail of the case is evi-

Ill. No. 42.—Artificial uppers selected to articulate with natural lowers. It is believed these teeth are harmonious in every particular with the face. The very light color which they exhibit is merely a printing effect.

dently the one who should master tooth selection and should order *by mould number,* leaving to the tooth clerk merely the duty of properly filling the order.

Some dentists have adopted this method in part, and in ordering teeth specify the length and width in millimeters. It is believed that a little more study and courage would enable them to carry their work one step farther and select the mould themselves. This would be much more satisfactory in the end.

It may be well to ask what has been learned which shall justify the use of this method of selection. It seems to the writer that these results can be summed up as follows:

First. Our own knowledge of artificial teeth has been greatly increased. Since the writer began the studies which led to these articles, he has learned things about artificial teeth which nobody ever took the pains to teach him, and which are of great practical value. By means of these studies we have learned to know what we want in artificial teeth; this has not always been the case in the past.

Second. We are now able to specify to the tooth clerk just what moulds we want—a thing impossible before. We may send or phone or write with a certainty of getting what we require.

Third.—We need not send models to the dealers. Sending the mould number answers every purpose. It also greatly facilitates orders being filled with rapidity and accuracy at the depot.

Fourth. We economize time. It takes a little time to learn to order moulds by this method, just as it takes a little time to learn to do anything else; but the writer has met many dentists who are pleased with this method, and their reports are that after the first two or three cases they were enabled to choose moulds to their complete satisfaction in a very few moments.

Fifth. There is no necessity to grind the teeth, provided we have used care in selecting.

Sixth. We get better artistic and mechanical results with very much less labor.

Seventh. Anatomical articulation of artificial teeth will soon be the standard method. It is now required in the colleges, and by law in some states. We older dentists must learn it or we shall soon be outclassed. This form of articulation will be greatly facilitated if we know first how to properly select the teeth for any given case.

CHAPTER VI

MOUNTING THE TRIAL PLATES AND MODELS ON THE ARTICULATOR—THE USE OF THE FACE BOW

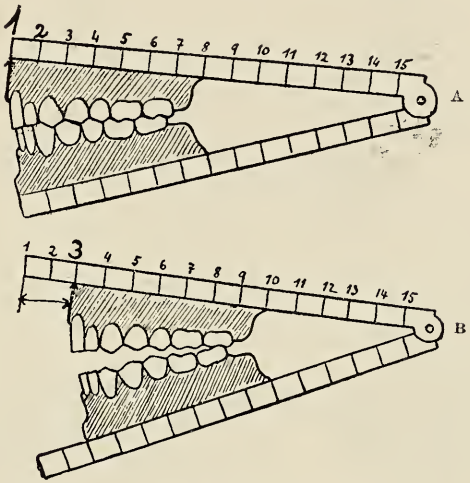
As one progresses in the practice of anatomical articulation he realizes more and more the necessity of accuracy at each step. For one step falsely made may defeat the greatest care at all other points.

Ill. No. 43 shows by means of a cardboard model the result that follows when the models are not attached at their proper distance from the condyles and the height of the bite must be changed. The models in *A*, in Ill. No. 43 have been attached too far forward, and the teeth have been articulated accordingly. When these are tried in the mouth, only the molars will come into contact, the incisors failing to meet, while on the contrary, when the models have been attached too far back, only the incisors will come into contact, and the molars will fail to meet.

Models can be accurately mounted on the articulator by only one means; that is the use of the face bow. When these articles were written, there was but one face bow generally known in this country, that made by Dr. George B. Snow. Since that time the excellent articulator of Dr. Gysi has been introduced to American dentists. It carries the face bow idea perhaps even farther than Dr. Snow applied it in ordinary work. The Gysi articluator requires more time and attention in the early stages of denture making than the one described in the following pages. The writer's opinion is, after very limited experience with it, that during the latter stages it saves as much time as it required extra in the earlier stages, and that it will make possible results never before within our reach. The writer understands that one of America's leading plate workers is about to produce a new articulator, and this feature will doubtless be embodied therein. While the distance from the condyle to the incisal edges of the lower centrals at the median line may average four inches, it varies in practice from 3⅝ to 4⅞ inches. Without entering into the mathematics of the effects of such varying distances, it may be said that it is well worth the necessary trouble to mount the models on the articulator in such a way as to reproduce the incisor-to-condyle distance peculiar to the case in hand.

Probably more dentures exhibit faulty articulation in the mouth because of the models having been incorrectly set on the articulator than from any other cause; for dentures set to articulate at one distance from the joint will not articulate at a greater or lesser distance when the height of the bite* is changed.

There is scarcely a probability of the models being placed on the articulator by chance so as to reproduce the condyle-to-incisor distance peculiar to that patient. Unless that distance is correctly reproduced, the dentures articulated on the models thus placed are less likely to articulate well in the mouth.



Ill. No. 43.—Upper half models attached to articulator with too great incisor-to-condyle distance and teeth articulated.

Lower half. The dentures, articulated as above, are put into the mouth. Only the molars strike. Such "guesswork" attachment of models to articulators accounts for many articulation failures. †

Many articulation failures can be avoided by accuracy at this point. This applies as strongly to dentures articulated in the common way as to those articulated anatomically.

With both trial plates in the mouth, the closure of the jaws in proper relations is secured by any method satisfactory to the operator.

While the jaws are held in these relations, continuous vertical marks should be made across the buccal surfaces of both trial plates so that they may be replaced in proper relations to each other after removing

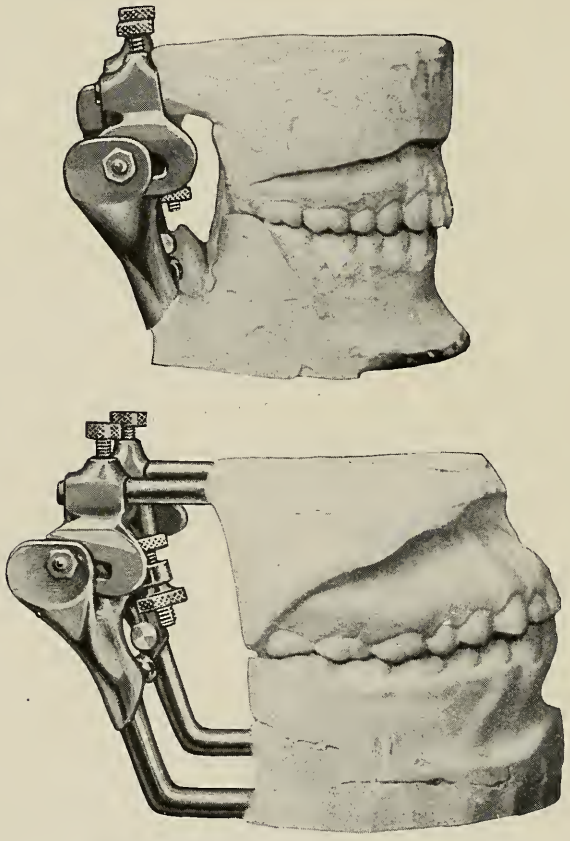
* By bite is here meant the separation between the upper and lower alveolar ridges in position of normal closure.

† Published by the courtesy of Dr. George B. Snow and reproduced from *The Dental Cosmos* for February, 1910.

from the mouth. They are then removed, placed in proper relations to each other and sealed together with a hot spatula.

Distortion of the trial plates will be much less likely to occur in handling, if they are placed on their respective models immediately after removing from the mouth and handled thus.

One portion of the Snow Face Bow consists of a straight cylindrical rod with a flat curved piece across the end;* this entire piece is known

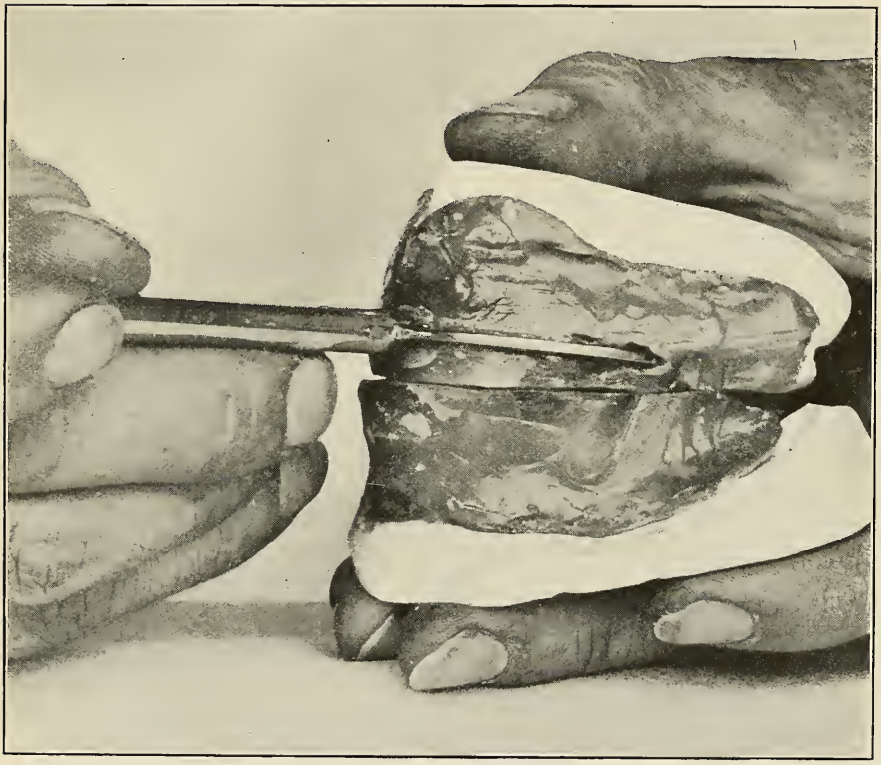


Ill. No. 44.—Models of two natural dentures showing wide variation in the incisor-to-condyle distance. In the upper model this distance is 3⅜ inches. In the lower, it is 4⅜ inches. For the significance of this variation, see Illustration No. 43.

as "the mouth piece." The flat curved cross part is now heated to a temperature which really softens wax, and is inserted deeply into the labial surface of the upper trial plate as nearly like Illustration No. 45 as possible.

* When this article was written, the form of the mouth piece in common use for this work was as described here. Since then another form has been introduced; literature making plain its use accompanies each face bow.

It will be noticed that the stem of the mouth piece* is parallel with the occlusal plane of the trial plates. It also projects forward as a continuation of the median line of the body. Care must be exercised to see that this mouth piece is firmly seated, so that the trial plates may be handled by it without loosening. In cases where it is difficult to seat it firmly in the manner shown here, it should be seated as well as may be and additional wax flowed about it.



Ill. No. 45.—Trimmed bites held on models and mouth piece of face bow firmly seated parallel with occlusal plane of bites.

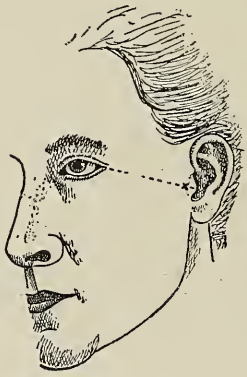
The trial plates, still fastened together and with the mouth piece attached, are laid aside while preparations are made for using the rest of the face bow. Place the finger on the side of the face and locate the head of each condyle. Perhaps this can be best done by having the patient depress the mandible so that the finger sinks into the depression

* Held in the right hand.

left behind the condyle as it moves forward. By having the jaw slowly closed, the return of the mandible to the position of rest can be followed and the head of the mandible located. It will usually be found about 10 mm. in front of the tragus of the ear and on a line toward the outer corner of the eye. When located, mark the skin over each condyle with a lead-pencil or chalk, so that the marks are plainly visible.

Put the trial plates, still fastened together, into the mouth and have the jaws closed into them. The stem of the mouth piece should then project forward in the median line.

The face bow presents, on either end, a sliding pointer with a clamping nut which locks it. From the central portion of the bow swings a



Ill. No. 46.—Location of head of condyle on bone from tragus of the ear to corner of eye.*

swivel clamp pierced by a hole for the stem of the mouth piece. This swivel clamp swings freely when the set screw is loosened.

Loosen the clamping nuts which fasten the pointers, and slide the pointers outward. With one end of the face bow in either hand and the bow projecting forward, pass the hole in the swivel clamp over the projecting stem of the mouth piece and place one pointer over each mark locating the head of the condyle. Press the pointers in firmly against the face, and move the bow to either side until the same number of marks on the pointers show between the frame of the bow and the face on both sides. This done, lock the clamping nut about each pointer. Support the back end of the face bow with one hand in such a way that

* Gysi, *Cosmos*, January, 1910.

neither pointer can move from its proper location over the head of the condyle. Then lock most firmly the swivel clamp about the stem of the mouth piece. This renders into one, for all practical purposes, the face bow, the mouth piece and the attached trial plates.

Or the clamping screw may be given in charge of the patient, with

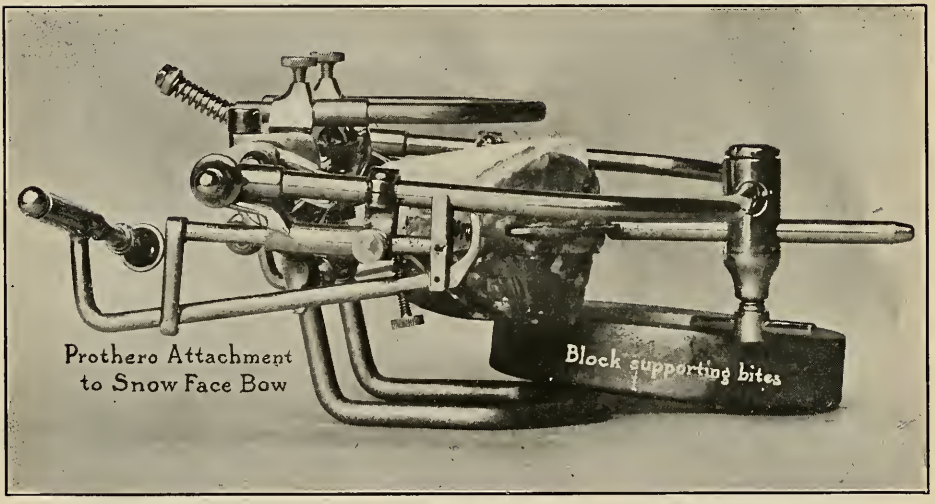
Ill. No. 47.—Face bow in position on patient's face. Prothero attachment on face bow to assist in proper adjustment. Bites in mouth with T piece projecting through swivel clamp on face bow.

directions to tighten it at the proper time. Then both hands of the operator will be free to adjust the pointers over the condyles. (After the patient has tightened the clamping screw, it is well for the operator to assure himself that it is tight enough.)

To overcome the difficulties which some meet in properly placing the face bow, Dr. J. H. Prothero devised an attachment for each of its extremities which facilitates proper placing. The attachment has a sliding rod to enter the external opening of each ear, and screws by which the pointers of the face bow may be raised and lowered, and moved forward and back.

The face bow, with the Prothero attachment, properly adjusted to the patient's face, may be seen in Illustration No. 47.

When the swivel clamp has been locked in place, fastening the trial plates immovably to the face bow, the clamping nut about each pointer



Ill. No 48.—Face bow and properly articulated bites mounted on articulator ready for attaching models to articulator bows.

should be loosened, the pointer moved outward, and face bow and bites removed as one.

The articulator may be quite simply prepared for mounting the models. If, at some convenient place in a bench, a nail be driven part way in and then bent over in such a way that the lower bow of the articulator slides under it and is thereby held close to the bench, the handling of the articulator will be made easier. By means of the set screw, adjust the model bows of the articulator so that they are parallel. Slide the lower bow under the nail referred to and throw the upper model bow back. The pointers of the face bow should be pushed in as far as possible and firmly locked. In the inner end of each pointer is a recess

which fits over a pin projecting from the outer framework of the articulator joint. The face bow should be spread a little and the recesses placed over the pins just mentioned. The face bow will then be held in the proper lateral position.

The trial plates should now be placed so that the occlusal surface is parallel with the lower model bow. If the steps so far described have been properly taken, it is necessary only to move the face bow up or down until the stem of the mouth piece is parallel with the surface of the table. This brings the occlusal plane of the bite parallel to the lower model bow. By means of a prop, the face bow is held in this position.

To mount the upper model, place it in its proper trial plate, bring the upper model bow forward above it, and push the movable sleeve on the model bow back against the framework of the articulator. Attach with plaster in the usual way, enclosing the forward end of the sleeve in the plaster.

To mount the lower model after the plaster attaching the upper model is set, invert the articulator, face bow and trial plates. Place the lower model in its trial plate, bring the model bow to position above it and attach with plaster in the usual way. Carry the plaster up at the heel in such a way as to include the framework of the articulator. It will then be a guide in replacing the bow should it be removed. Carve out the plaster which forms the center of the lower model, leaving the ridge supported by the plaster above the bow. This permits much better access to the lingual surfaces of the trial plates and teeth.

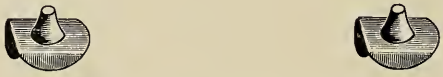
The face bow and mouth piece may be removed, leaving the models attached to the articulator in positions which reproduce any peculiarities of the case. The importance of such model mounting has been mentioned, but it is worthy of mention again. Whether or not the dentures are to be anatomically articulated, the models should be mounted in this manner. And it is probably true that unless they are mounted thus accurately, articulation of the teeth to give satisfactory results in the mouth will be more difficult or wholly impossible.

CHAPTER VII

DETERMINING THE CONDYLE PATHS

When the models have been properly mounted on the articulator by means of the trial plates and face bow, the inclination of the condyle paths of that particular patient should be determined. There is something of a formidable sound about that term "determining the condyle paths." It savors of something that we know but little about. And many dentists have doubtless been deterred from mastering this part of the work by the name given to it.

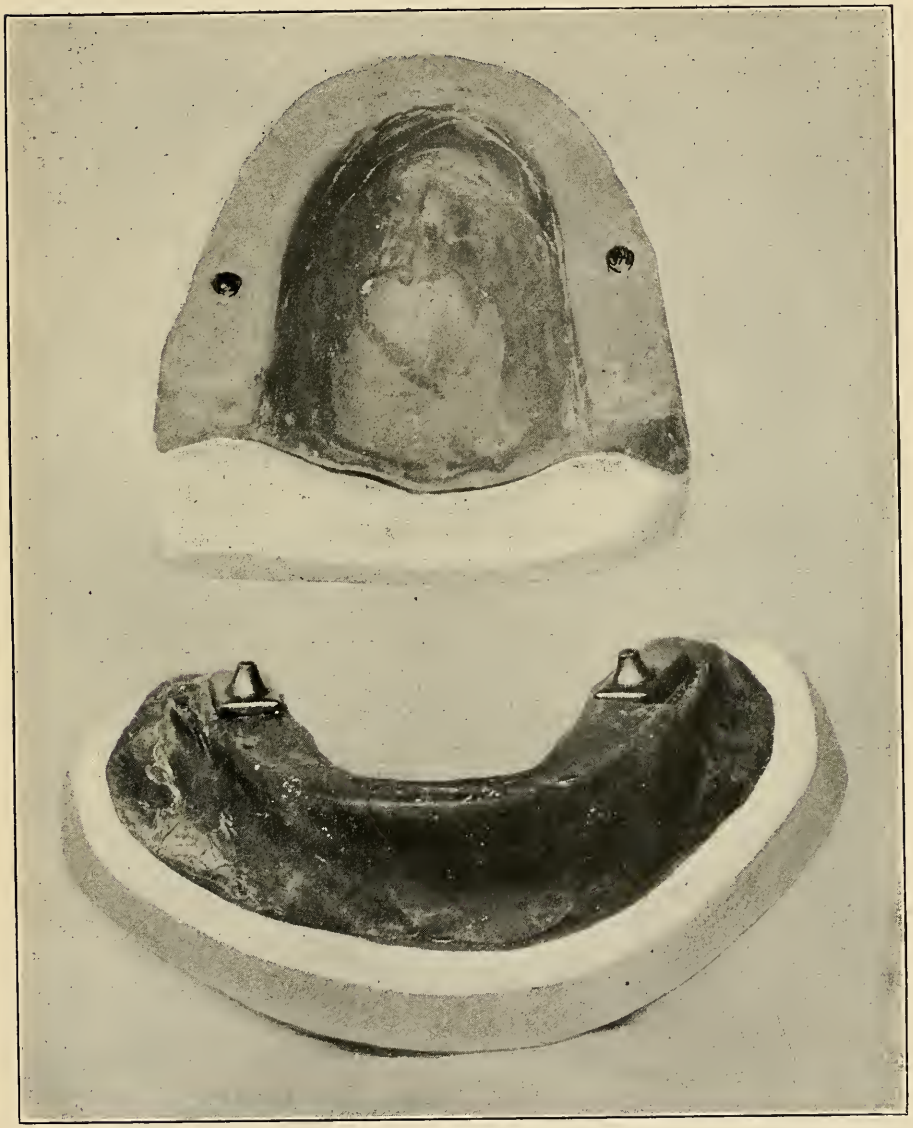
But the step itself is really very simple, thanks to the mechanical appliances now available. It is not more complicated or difficult than the use of the face bow. A few words of explanation as to why it is necessary may not be amiss.



Ill. No. 49.—Bite gauges as furnished with articulator.

All persons do not chew alike, at least so far as the movement of the condyle is concerned. In a few people the condyle moves almost horizontally forward and back. In others, it moves nearly straight up and down. Between those horizontal and vertical extremes there may be found in different people, almost every degree of variation. The

average condyle path probably shows an inclination of 33 degrees* from a horizontal line, running from the ear to the nose, as in Illustration No. 14.



Ill. No. 50.—Lower trial plate with " bite plates " in proper position. Upper trial plate showing holes made by cones of " bite gauges " when protruded bite is taken.

* Gysi, *Cosmos*, January, 1910.

Many dentists use articulators having fixed condyle paths. Some have horizontal condyle paths and others have an inclination approximating 33 degrees. Articulators with horizontal condyle slots are, in the writer's opinion, but little better than plain line articulators. Those articulators having condyle slots of approximately average inclination are much superior to those having no such slots, or only horizontal ones. For many cases, articulators with fixed condyle slots of medium inclination will prove quite satisfactory. They offer a possible short cut to the desired end of good articulation. But for many cases they must be insufficient, and one could never know whether or not this was the case, save as dentures articulated on them, fell short of full service in the mouth.

The practice of determining the condyle path for each side of the patient's face is so simple, once the procedure is understood, and requires so little labor that it must appeal to every ambitious prosthetic worker as the more desirable course.* Furthermore, one need know little of the theories involved, to bring success. It is necessary only to follow certain easy mechanical steps and abide by the results. While the determination of the condyle path is here described only in connection with the denture making, it is quite as valuable to the crown and bridge worker. By making full models of both jaws, mounting them by means of the face bow, and determining the condyle paths of the patient, the stress to which the crown or bridge will be subjected in service will be at once apparent. And crowns or bridges may be so prepared as to avoid or successfully withstand strains which, but for these precautions, would have been unrecognized and perhaps fatal to the piece.

THE PROTRUDED BITE

With at least one of the articulators adapted for this work, there are furnished two little objects known as "bite gauges." See Illustration No. 40. These are useful in maintaining the trial plates in proper relations, as will be shown. The bite gauges are set into the occlusal surface of the lower trial plate, as in Illustration No. 50. When the upper trial plate is closed down onto them, the conical portions pierce it, as shown in the same illustration.

* The method of determining the condyle path here described is that used in connection with The Snow Articulator and Face Bow. The somewhat different method employed in connection with the Gysi articulator can be learned upon applying to the importers, The Dentists' Supply Company of New York.

Both trial plates are now placed in the patient's mouth. Before closing the jaws together, the patient is instructed to thrust the lower jaw forward about ⅛ of an inch. In this position the lower jaw is moved upward until the trial plates are in contact anteriorly. In the

Ill. No. 51.—Getting the protruded bite. The separator between trial plates at heels, as recorded and maintained by the "bite gauges," is clearly shown.

majority of cases there will be a greater or less separation of the trial plates in the posterior section, as may be seen by careful inspection of Illustration No. 51.

Here the advantages of the conical upward projections of the bite gauges are manifest. They preserve the separation between the trial plates posteriorly and help retain them in the proper forward and back relations.

As soon as the trial plates come together anteriorly, staples like the one visible in Illustration No. 52 are inserted as there shown. A better form of staple can be made by twisting two pieces of wire tightly together and then turning all four points over, forming a pointed staple. It is sometimes advantageous to melt a little of the wax of the ridges about the staples, making their retention more secure and preventing any changes in the relative positions of the trial plates. The trial plates, thus fastened together, are taken from the mouth. By the aid of a hot spatula they should be sealed firmly together on the lingual surfaces of the ridge at the median line and also at the location of the bite gauges. This prevents any motion between them at the next stage of the work, and is most important.

A SHORT CUT

When it is desired to dismiss the patient as soon as possible, and to have only one appointment previous to trying the dentures in, a shorter method may be used, producing the same results. It is, however, slightly more confusing until one is accustomed to the work.

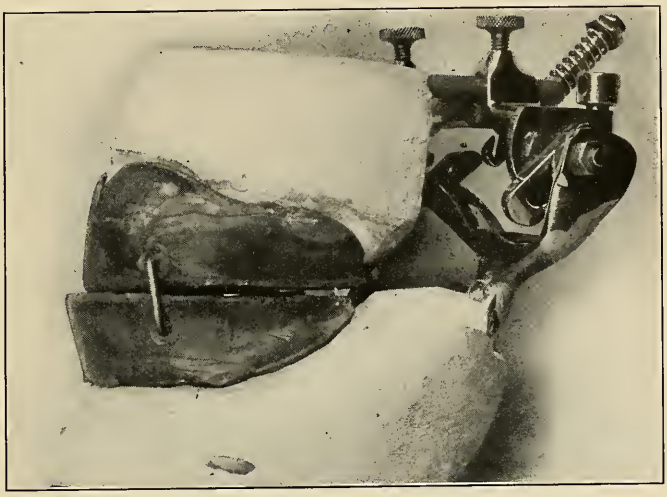
To use the shorter method, establish the "occlusal plane" as usual, and trim the trial plates vertically to proper heights. Remove the lower from the mouth and put the bite gauges in place. Place the lower trial plate, carrying the bite gauges, in the mouth and have the patient protrude the lower jaw and bite as described above. With the trial plates in this position, any desired marks may be made to register their relations; but they should not be fastened together.

The lower trial plate may be now taken from the mouth and the bite gauges removed. The lower trial plate is then replaced in the mouth, the jaws are closed together with the lower properly retruded, and marks are made across both to show their relations. These marks should not interfere with those made in the position of the protruded bite.

Both trial plates are removed from the mouth and fastened together; the mouth piece of the face bow is inserted as before described, and the models are mounted on the articulator by means of the face bow and trial plates.

When mounting on the articulator is complete, the trial plates are carefully separated, the bite gauges are replaced in the spots from which

they were taken, the spring of the articulator is detached from the lower portion, and the lower trial plate and model are protruded until the bite



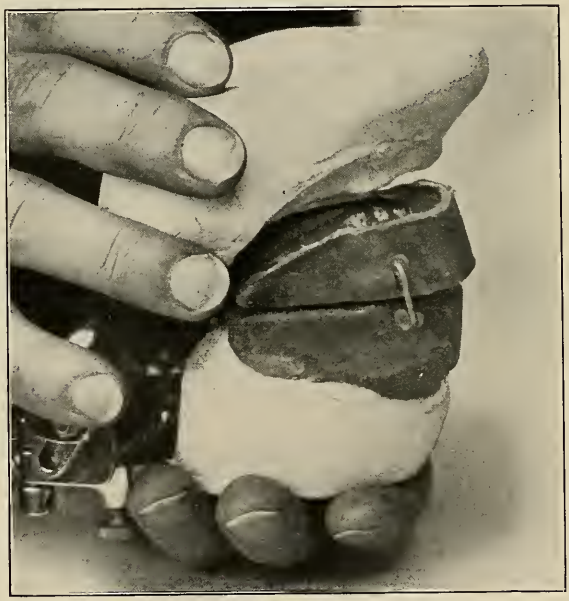
Ill. No. 52.—Side view of trial plates following taking of protruded bite.

gauges fit into the depressions which they made in the upper trial plate when both were in the mouth. The trial plates are then sealed immovably together. This brings the work up to its present stage, but shortens somewhat the length of time the patient must remain in the office.

ADJUSTING THE CONDYLE SLOTS

An important part of the joint of the articulator here used is a slot on each side which may be adjusted to any desired position within a considerable range of movement. The adjustable feature is controlled by a set screw, somewhat above and behind each slot, which locks it in the selected position or allows further adjustment. A pin fastened to the lower jaw, or mandible of the articulator fits loosely in each slot, and may be moved forward or backward the length of the slot. This pin is usually held in the most retruded position by the spring on the back of the articulator. In practical work, the condyle slot represents the eminentia articularis of the skull, and the pin in the condyle slot represents the condyle which slides on the eminence.

When the bite was first taken in the patient's mouth, it was with the lower jaw in a retruded position. With the upper and lower jaws in this relation the models were mounted upon the articulator. The protruded bite brought the condyles into the forward position. In order to give this bite, the condyles were compelled to move forward and downward along the paths peculiar to that patient. In the pro-



Ill. No. 53.—Adjusting the inclinations of the condyle slots by placing the lower model in the lower bite.

truded position of the mandible, the flat trial plates showed a certain amount of separation in the molar region, and this separation was carefully preserved by the bite gauges used for that purpose.

The upper trial plate, with the lower fastened to it as described above, is now placed on the upper model, and by means of melted wax applied at the edge of the trial plate, is fastened there.

The spring which holds the two parts of the articulator in action is released from the lower part; and the set screws which lock the condyle slots in position are loosened so that the slots move easily.

The articulator with models and trial plates attached, is now inverted as in Illustration No. 53. The lower model is carefully placed in the lower trial plate and brought down to proper position all around.

The bringing of the lower model into its proper position will re-

quire that the condyle slots of the articulator take on a certain slant. This slant will depend largely on the amount of separation between the trial plates in the posterior section. Adjustment of the slots by hand often facilitates their taking the proper slant.

When the lower model rests in its proper place in the lower trial plate the correctness of the slope of the slots may be easily determined. Move first one slot and then the other gently from the present position, and note whether the relations between the lower trial plate and the lower model are disturbed. When each step has been carefully taken, any movement of the condyle slots will be reflected in a movement of the lower model.

At that adjustment of the condyle slots which permits the lower model to rest evenly in the lower trial plate, the set screws should be turned until the slots are immovable.

There will often be a difference between the slopes of the slots on the two sides, one sloping more than the other. If the preceding steps have all been taken with care, this difference need cause no uneasiness. The same difference doubtless exists between the condyle paths of the patient. It is said to be due to extraction of teeth on one side of the mouth before the similar teeth on the other side were lost. Gysi reports having found as much as 50 degrees of variation between the condyle paths on opposite sides of the same face.

Should the articulator show a difference of more than 10 or 15 degrees (the space between each two marks on the quadrants over which the condyle slots slide is equal to 10 geographical degrees), care should be exercised to see that the adjustments are correct.

Dentists using articulators with fixed condyle slots will be unable to make this slot adjustment. Such instruments are very satisfactory for cases showing approximately average condyle paths. But one can never know just how great the condyle slope should be, or whether a case is an " average case " until this adjustment is made. Articulators having condyle slots fixed in a horizontal plane, or nearly so, will be found quite unsuited for accurate work, and dentists using them will necessarily confine themselves to setting up teeth for occlusion, or mere open and shut, rather than for articulation.

Having adjusted the condyle slots and locked the set screws, the staples and bite gauges may be removed from the trial plates, the spring may be engaged with the lower part of the articulator, and the lower trial plate pulled back to its retruded position.

The next step will be to carve, by the guidance of the condyle paths as we have adjusted them, the compensating and lateral curves.

CHAPTER VIII

WORKING OUT THE TOOTH CURVES

The inclined condyle slots are to be the guides in working out two curves in the occlusal surfaces of the wax trial plates. These are the curves which maintain the balancing relations between the dentures when the jaw is moved forward or laterally. They are known as the Compensating Curve, or curve of Spee, and the Lateral Curve. In cases where the condyle slots are inclined but little from horizontal, these curves will be comparatively flat. When the condyle slots are inclined 33 degrees or more, the curves will be found quite marked.

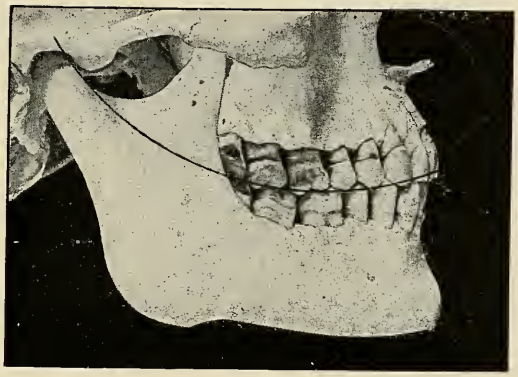
The compensating curve runs from front to back. It is formed by the arrangement of the teeth and elevates the upper second molar above the plane of the anterior teeth. See Illustration No. 54. These curves are usually rather flat in their beginnings, but if worked out to an exaggerated degree, often become very marked. It is believed, however, that nothing is gained by working them out to an exaggerated degree.

The lateral curve runs across the trial plates at right angles to the compensating curve, that is from buccal side to buccal side. Like the compensating curve, it is convex on the upper jaw. This convexity is greatest in the molar region.

The following methods make the carving of these curves much more easy and rapid than formerly.

Upon the occlusal surface of the lower trial plate, which was made flat and has not been changed, is dusted a white powder, such as soapstone or talcum, with sufficient evenness so that any scratches upon that surface will show. The trial plates are then closed together and gentle pressure is made from the most anterior portion of the upper model to

the most anterior portion of the lower model by means of the thumb and finger. By pressure on the anterior end of either condyle slot the upper model is moved laterally back and forth several times. When the trial plates are separated it will be seen that the occlusal margin of the upper trial plate, on one side, has rubbed the powder noticeably in several spots. If both occlusal surfaces are smooth and level, this rubbing will probably occur first in the bicuspid region. This is shown by the dark spot on the occlusal surface of the lower trial plate at the location of the right bicuspids in Illustration No. 55.



Ill. No. 54.—The compensating curve and its relation to the teeth.*

The wax of the lower trial plate is now scraped where the powder was rubbed. For this some workers prefer an old blade from a safety razor, and some prefer a wooden handled ink eraser, such as is common in business offices. When the wax in the rubbed area has been hollowed somewhat, fresh powder should be dusted on and the rubbing and scraping process repeated. When the necessary technic has been acquired, the scraping or carving can be done rapidly, since the indications of the first rubbing will prove a reasonably accurate guide for extensive carving. But it cannot be urged too strongly upon dentists who care to anatomically articulate dentures, that in the first two or three sets of trial plates there should be given to this carving enough time and attention to demonstrate the principles and methods involved. The time spent in doing this will bring ample rewards in the future. Trial plate making will never again offer difficulties.

This form of carving should be continued on one side only until the upper trial plate rubs the powdered surface of the lower to the outer

* Courtesy of Lea and Febiger.

margin on that side. The other side may then be carved in like manner. This is as far as this form of carving should be carried, since it is not desired to lower the labial margin of the lower trial plate. If the trial plates be now closed together and examined from the lingual, it will be

Ill. No. 55.—Moving the upper model laterally rubs the powdered surface of the lower trial plate.

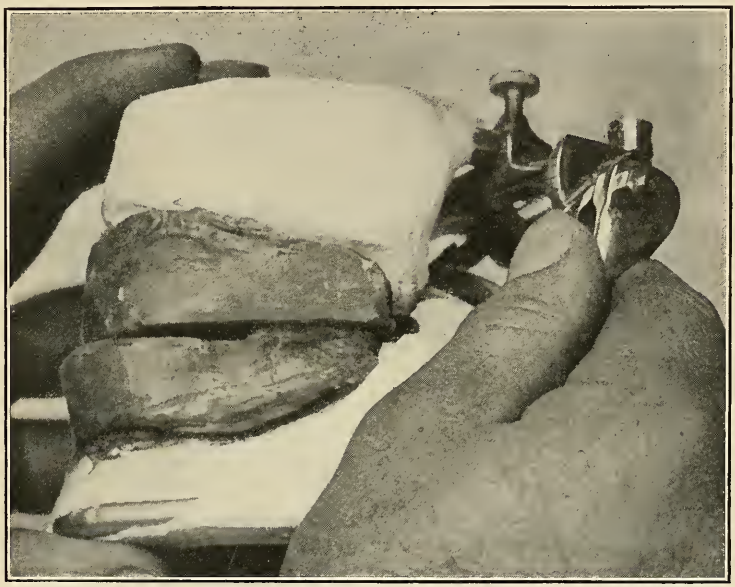
seen that while the outer margin of the lower trial plate remains undisturbed, the occlusal surface has been considerably inclined toward the lingual. This inclination will be least in the molar region and greatest at the median line.

If the upper model be moved to the right the trial plates will now remain in contact on the left side, but separate noticeably in the molar region on the right. The amount of separation will depend almost wholly on the inclination of the condyle slots. If this inclination be very slight, say only 10 degrees, separation between the heels will be slight. If, however, the inclination of the condyle slots be 33 degrees, which Gysi thinks is the average, the separation will be noticeable. If the inclination of the condyle slots should be 60 or 70 degrees, as is found in some cases, the separation will be very marked.

The next task is to so continue the curves in the occlusal surfaces of both trial plates that this separation in the lateral movement may be

overcome. This may be done by building up the heel of the lower trial plate into the compensating curve and then carving the heel of the upper trial plate to fit the lower as thus built.*

The heel of the lower trial plate is built up as follows:—Cut across one end of a sheet of base-plate wax as it comes in the box, making a strip about three-fourths of an inch wide. Soften this on one side and fold, and repeat the softening and folding until a roll has been made which is soft all the way through. With gentle heat, soften one heel of



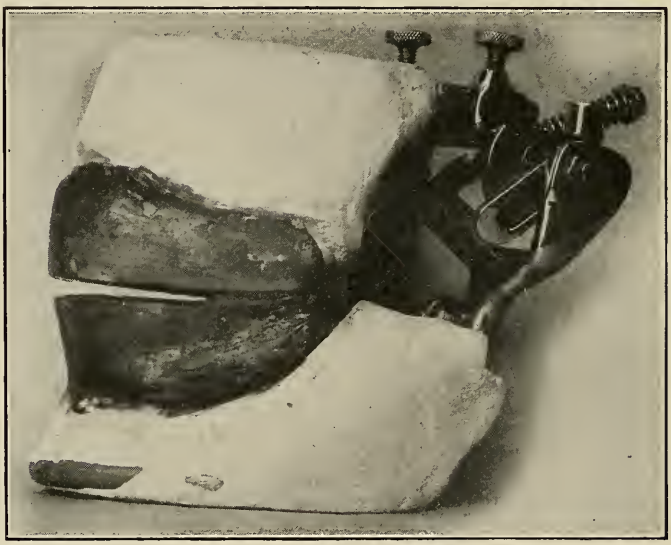
Ill. No. 56.—Upper models moved laterally and pressed down on roll on heel of lower bite.

the lower trial plate, place the little roll thus made on the heel, and attach it firmly by means of a hot spatula thrust through the roll and into the wax. When the union is sufficiently firm for working purposes, moisten with water the occlusal surface of the upper trial plate directly over the roll. Before bringing the trial plate together, move the upper model about one-eighth of an inch toward the side on which the roll is attached. With the upper thus moved laterally, press the models together until the trial plates come in contact on the side opposite to the roll. (See Illustration No. 56.) Separate the trial plates and trim away the excess of wax to the lingual and buccal. It will be observed that the

* Credit for the following method should be given to Dr. E. S. Ulsaver. It is one of the best mechanical steps in this method.

upper ridge did not flatten the roll horizontally, but that this surface shows an inclination upward and backward from the occlusal surface of the lower trial plate. This is the beginning of the compensating curve. This surface also slopes lingually; that is, the elevation is less at the lingual margin than at the buccal margin. This is the beginning of the lateral curve in this section.

It has been suggested that the upper model be moved laterally only about one-eighth of an inch, because it is found that if the model be



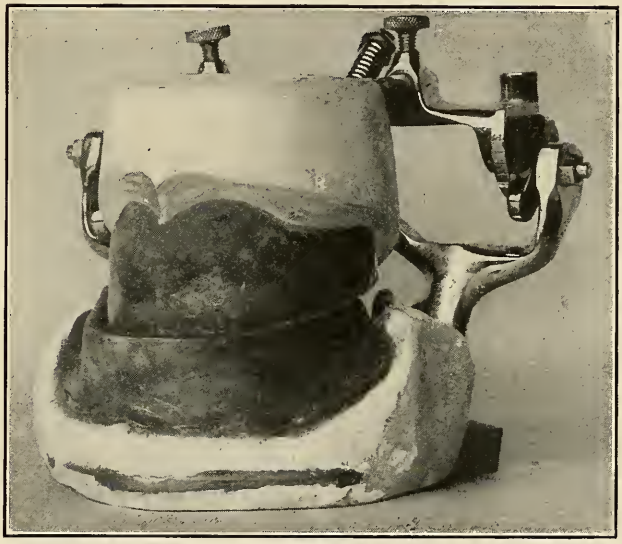
ILL. No. 57.—Bites, in central occlusion, kept apart by built-up heel of lower.

pulled farther, the compensating and lateral curves are exaggerated. So far as we are able to determine at present, practically all the benefits that would be possible from even the most exaggerated curve are secured by the curve that results from moving the upper model one-eighth of an inch. Dentists who wish to carry their education out in this matter will find it profitable to make a set of trial plates and in carving to move the upper model as far laterally as the articulator permits. This will give an understanding of the compensating and lateral curves which will be impossible of attainment by any other means.

When the upper model is allowed to return to a position of central occlusion, the trial plates will be kept apart by the built-up heel of the lower. (See Illustration No. 57.) At the point of contact with the

lower, the upper must be carved to permit the trial plates to come together all around. Begin scraping at the buccal-occlusal margin in the cuspid region, scraping harder as the heel is approached. The scraped surface of the upper should have just the same upward and backward inclination as the built-up heel of the lower. It should have just the same lateral curve, so that in the position of central occlusion the built-up surface of the lower and the scraped surface of the upper, show nearly exact contact.

The heel of the upper should be scraped in a curve somewhat longer than that shown by the built-up wax on the lower trial plate. That probably extended forward only to the bicuspids. It terminated abruptly, leaving a sort of "jumping-off place." The curve of the



Ill. No. 58.—The compensating and lateral curves so worked out that the trial plates do not separate.

upper necessary to fit the built-up lower may be carried forward to the location of the cuspid. When the trial plates are in contact all around, this will leave a triangular open space anterior to the flattened roll. This should be built in with soft wax and the upper trial plate moistened and closed down on it. This will shape it to conform to the curve in the upper.

If, by pressure on the same condyle slot as before, the upper model be now moved laterally, a slight separation will probably occur between the heels of the upper and lower trial plates. This is due to the fact

that the upward curve of the lower trial plate was shaped by the occlusal surface of the untrimmed upper. The upper now having been trimmed, its occlusal surface occupies a somewhat different position, hence the separation. Another roll of wax is attached to the occlusal surface of the lower trial plate in the same place and in the same way as the first. The occlusal surface of the upper is moistened and the upper model is again moved slightly toward that side and pressed down until the trial plates come in contact, on the opposite side. This will be found to again increase the height of the heel of the lower on that side and to increase also the compensating and lateral curves. The upper trial plate is again carved on that side until proper relations are established. It may now be found that when the upper-model is moved laterally through the one-eighth inch of distance, the heels of the two trial plates will not separate. Should a separation of any size occur, it may be remedied by a third building in like fashion. By this means, the compensating and lateral curves may be so accurately worked out that no separation is perceptible between the trial plates through the range of movement mentioned. The trimming of the wax may usually be accomplished in much less time than is here required to describe it, and with a little practice the whole operation becomes very rapid.

Meantime, the opposite sides of the trial plates have remained untouched. Both sides should not be put in work at the same time. That is, if the left side is begun, it should be finished before the right side is touched. If this is not done, but both sides are put in work at the same time, the accuracy secured by the several mechanical steps here outlined will be lost. The carving will become merely time-consuming and vexatious guesswork. Before the method mentioned above for working out the curves was devised, the writer has several times spent an entire working day carving one set of upper and lower trial plates to proper articulation. At least equal articulation between the trial plates may be now accomplished in from 45 to 60 minutes.

CHAPTER IX

ARTICULATING THE TEETH

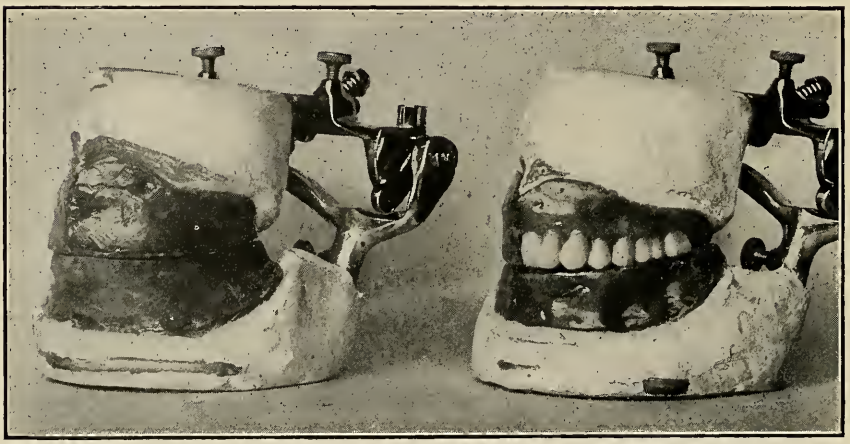
When the compensating and lateral curves have been worked out in the trial plates, the matter of correctly articulating the teeth becomes very simple, provided proper moulds of teeth are used. The ridge on one-half of the upper trial plate is cut away, beginning at the median line. The upper central on that side is set first, bringing its incisal edge in contact with the incisal margin of the lower wax. If the teeth have been selected by the method outlined in an earlier paper, it will doubtless be found that this tooth will go to place without grinding. The rest of the half set are then placed in position, in orderly sequence.

In the setting of the bicuspids and molars, it will make a great difference to the worker what moulds of teeth are used. The bicuspids and molars to the use of which dentists have, until lately, been confined, are not adapted for anatomical articulation, or indeed to successful articulation in any form. The writer does not know how lifelike were the originals from which these have descended, but certainly these now bear no noticeable resemblance to natural teeth. The relative heights of the buccal and lingual cusps are far from correct, and the cusp formation in general is not such as to elicit the praise of close observers.

Nor is it practicable for the dentist to so grind these teeth that proper articulation shall result. The proper articulation of 28 teeth requires an accuracy in proportion and in cusp and sulci formation

which can hardly be accomplished by grinding. And even though it could, few dentists have the training, the patience or the time for it. Dentists who desire to undertake this labor of grinding are referred to the writings of Dr. George H. Wilson of Cleveland, O., who is very expert in this line. As, however, Dr. Wilson spends several hours per denture in securing these results, and as all of these results with others, can be obtained by the use of anatomical moulds in bicuspids and molars, it is assumed that the dentist prefers to use these.

Since the introduction of the anatomical bicuspids and molars, practically all of this grinding has become unnecessary. And results which no grinding is likely to parallel are attained almost without labor.



Ill. No. 59.—On the left: wax trial plates, curves worked out, ready for setting teeth. On the right: half of upper ridge cut away and teeth set.

The anatomical bicuspids and molars are reproductions of the best forms of natural teeth at the period of middle life. The mesio-distal and bucco-lingual proportions of the natural teeth remain unchanged. The buccal surfaces are as in the natural teeth, save that the buccal markings in the molars are accentuated.

The occlusal surfaces are changed from the natural forms only so far as it is required by the use of two molars on artificial dentures, in place of three in the natural denture. The cusps show the wear common to natural teeth in middle life and are lowered thereby from their greater height in youth. This shortening of the cusps by wear is a very common occurrence in the natural teeth. The shortened cusps materially assist the dentist in securing articulation and reduce the danger of the dentures being dislodged. Deep cusps on artificial bicuspids and

molars add nothing to the effectiveness of the teeth and prove sources of annoyance to the patient.

The upper and lower teeth in the anatomical moulds are carved to articulation, one with the other. When opposed, they take their places with a definiteness that cannot fail to please one accustomed to the uncertain articulation of the forms in common use.

These anatomical moulds may now be had in four sizes, a small, a small medium with rather small upper molars, a medium, and a large. Other moulds are in preparation.

While the artistic suitability of given moulds is an important consideration in the selection of anterior teeth for any case, the bicuspids and molars may be selected with less reference to art. In these teeth, the questions of size, proportions and articulation are most important. The bicuspids and molars must not be too large to go well to place. They must be properly proportioned in all their dimensions; and they should articulate with the opposing teeth as perfectly as may be.

Practically all the requirements of actual plate work may be met by the use of a few properly graded sizes of bicuspids and molars. And the anatomical moulds as thus offered, carded with anteriors of suitable sizes, meet very well indeed the practical demands of denture making.

Moreover, these bicuspids and molars are shaped, on the ridgelap, like half saddle back moulds. This makes them relatively shallow. For very close bite cases, where little vertical space can be had between the ridges, the pins may be bent upward against the porcelain, yielding a very shallow form of tooth.

When the upper teeth on the one side now "in work" have been set so that the occlusal surfaces rest against the occlusal surface of the lower trial plate, they should be waxed firmly in position in order that they may serve as guides for the movements of the models in setting the teeth on the other side.

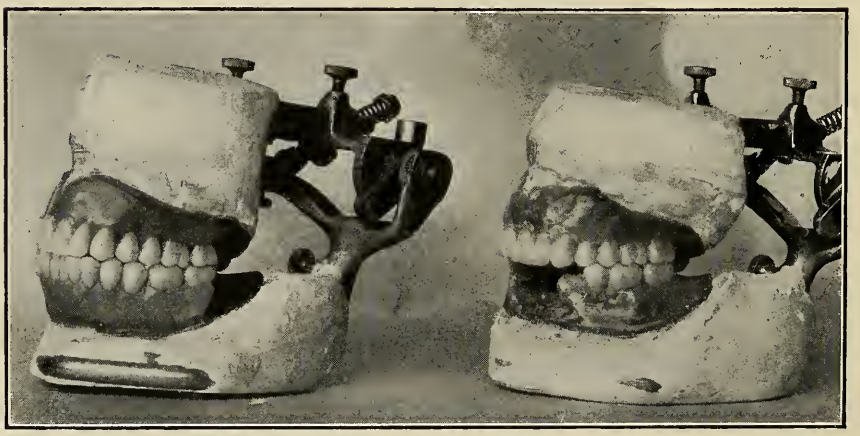
During the setting of the upper teeth, the articulator should be used as a plain hinge articulator and the teeth should be set so that all cusps lie in contact with the wax of the lower trial plate.

The other half of the ridge of the upper trial plate is now removed and the balance of the upper set, beginning with the centrals, is set in like manner as the first half.

Having now set the upper teeth so that they occlude properly with the lower wax their positions with reference to articulation may be tested. Move the upper model laterally about one-eighth inch from the position of central occlusion, and observe the relations of the buccal and lingual cusps to the occlusal surface of the lower trial plate. On the side toward which the upper model is moved, the lingual cusps should

be evenly in contact with the lower wax. The buccal cusps on the opposing side should be in contact with the lower wax, as should the lingual cusps if the movement has not carried them lingually off that trial plate. When the relations of the teeth are satisfactory in this position, the upper model should be moved to the other side and correct relations between teeth and trial plate established. When the proper relations are assured and the teeth are waxed firmly in position, half of the ridge of the lower trial plate is cut away, preparatory to the setting of the lower teeth.

As the first molar is the most anterior lower tooth which has two



Ill. No. 60.—On the right: upper set all in place; half of lower ridge cut away and lower teeth partly set. On the left: both sets set; both plates vulcanized and remounted on articulator for grinding.

lingual cusps, it is suggested that this tooth be set first. With the anatomical moulds used in these illustrations, the articulation between uppers and lowers is so exact that the lower first molar goes to a definite place and lodges there. It should be waxed in position. The lower second molar should then be placed in position on the wax and the lower second bicuspid and first bicuspid set. These having been firmly waxed in their proper positions, the other half of the lower ridge is cut out and the same teeth on the opposite side set in the same order and waxed in position. It now remains only for the dentist to set the lower anteriors in position and in such artistic arrangement as he prefers.

The articulation between uppers and lowers should be made as exact as possible without grinding the teeth. Because of the correctness of

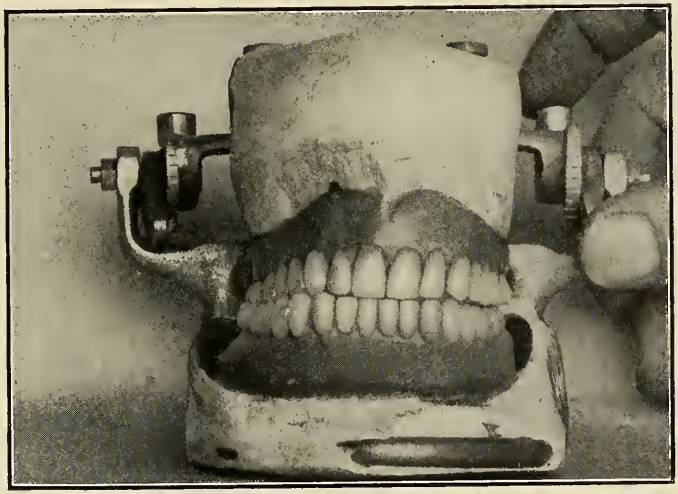
shape of the occlusal surfaces and the time-saving method of grinding to be outlined later, it will be found unwise to spend time in grinding the occlusal surfaces of the teeth in the ordinary manner.

It will doubtless be well to try the teeth in the mouth and have the patient make the usual masticatory movements. If the foregoing steps have been rightly carried out, few changes will be found necessary.

PERFECTING THE ARTICULATION

It will be noticed that no grinding has so far been done to adapt the teeth to position and the time and labor saved by this omission will be very noticeable. The following method for perfecting the articulation is suggested:

When the dentures are seen to be satisfactory, the upper, together



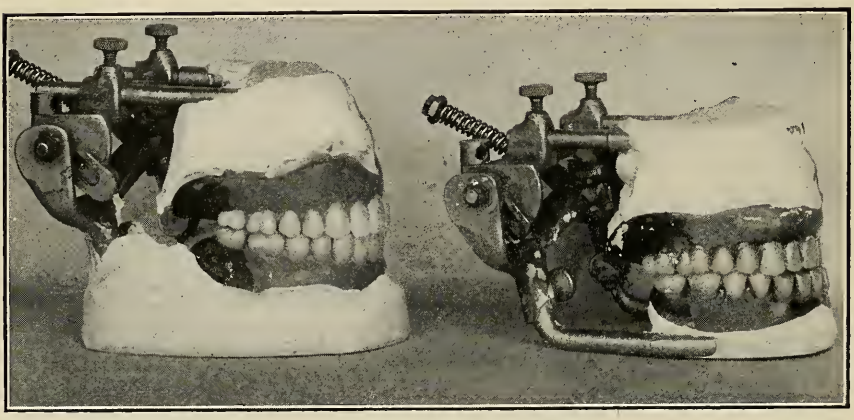
Ill. No. 61.—Anatomical articulation in lateral excursion of the mandible. Note form of contact on both sides.

with its model, is removed from the articulator and vulcanized in the usual way. This leaves the lower model, with the teeth in position, on the articulator. When the upper plate has been vulcanized, it is very carefully articulated with the lower, and while so articulated is filled with plaster and again attached to the upper model bow. The lower model and plate are removed and the plate vulcanized in the usual manner. It then is carefully articulated with the upper which is now in its former position on the articulator, and attached to the lower model bow in the same way. A thick paste made of carborundum pow-

der and oil is smeared over the occlusal and incisal surfaces of the teeth and both sets are firmly rubbed together through every biting and grinding motion permitted by the slant of the condyle slots, which remains unchanged. With the moulds of teeth here suggested the only points which will need grinding are those which may have received undue elevation by the manner of setting or by slight variations in the flow of the porcelain during baking.

The following advantages are gained by this method of grinding:—

The articulation is made much more perfect than by the usual method. This form of grinding takes down the little contact points



Ill. No. 62.—On the right: dentures made on a plain line articulator. They were set with flat occlusal planes for a patient having a condyle path inclined 50°. On the left: dentures anatomically articulated with the compensating curve required for the case.

which present very close adaptation. Many of these little points would be difficult of location for reduction with a stone.

The grinding is done more rapidly than in the usual way. From fifteen to thirty minutes completes the grinding.

The surfaces of the teeth are altered to only the necessary extent. These moulds require no general alterations to permit close articulation.

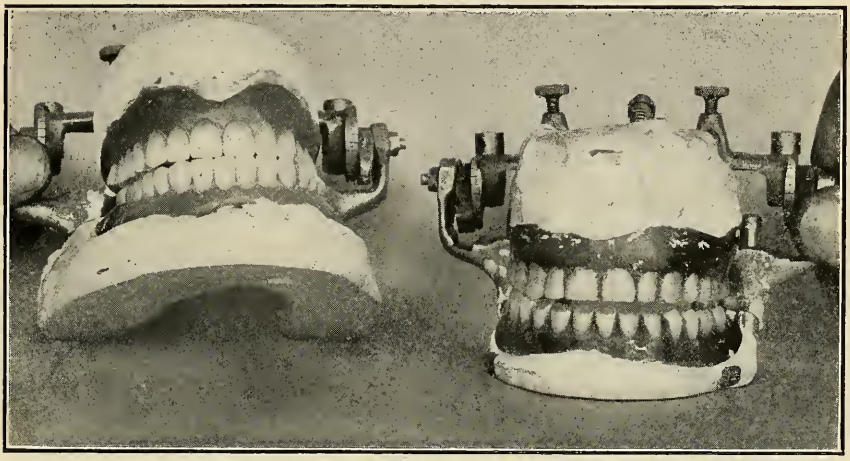
The glaze is removed from the occlusal surfaces of the bicuspids and molars, thereby facilitating the retention and crushing of food.

The anterior teeth are automatically "aged" in just the manner suitable to the case.

The adaptation of the upper and lower dentures, when this grinding is complete, will naturally be affected by the amount of experience and care of the worker, but after a few dentures have been made by these methods, the following adaptations should be present:

When the upper jaw is moved laterally so as to bring the buccal

surfaces of the upper and lower teeth on one side into the same vertical plane, there should be contact of all the upper and lower teeth on that side from the centrals or laterals backward. The interdigitation of the buccal cusps should be nearly exact and that of the lingual cusps should be sufficiently close for all practical purposes. At the same time the teeth on the opposite side of the upper denture, that is on the side not engaged in rushing, should be in contact with the lower teeth on that side, from the upper first bicuspid back. In other words, it is possible to so set the dentures that only three teeth in the upper denture



Ill. No. 63.—Same dentures as shown in previous illustration. Here thrown into lateral occlusion. The one on the left is tilted to show balancing contact of right molars. Notice separation between left molars in dentures on right hand.

will be out of contact while the dentures are in this relation. These teeth are the central, lateral and cuspid of the side not engaged in crushing.

The adaptation in the incising bite is as follows. If by even pressure on both condyle slots, the upper model be carried backward until the upper incisors are in the end-to-end bite with the lower incisors, there should be a contact between each upper tooth and its opposing lower.

The upper cuspids will be in contact with the lower first bicuspid; the upper first bicuspid with the lower second bicuspid; the upper second bicuspid with the mesial cusp of the lower first molar; the upper first molar in contact with the lower first and second molars and the upper second molar in contact with the lower second molar. The result will be that during the incising bite, when the incisors come together in the end-to-end contact, the upper denture will be supported throughout its entire length on both sides by lower teeth. In the final incising

bite, when the lower incisors pass upward and inward along the upper incisors, the buccal cusps of each bicuspid and molar will slide down the appropriate inclined plane of the lower tooth.

ILL. No. 64.—Artificial dentures in place. The mandible is here thrown to the right, bringing the buccal cusps of both sets into the same vertical plane and interdigitating them. This relation is necessary for mastication and the proper support of the dentures.

WHAT ARE THE RESULTS OF THESE STEPS, AND ARE THEY WORTH THE TROUBLE INVOLVED?

It is difficult to compare these results with those from plate work done in a haphazard manner, because there is no comparison in the

value of the service rendered to the patient. In the ordinary form of plate work, any real crushing or chewing ability which the patient may have is largely a matter of accident. With the method here outlined, certainty replaces guesswork at nearly every step, and in at least a very large proportion of cases, satisfactory results are assured.

Patients for whom dentures articulated in the ordinary manner have been removed and anatomically articulated dentures furnished, have been given much greater grinding power and such greatly increased satisfaction that one can say only that the average results from this form of work are such as could not be attained in the ordinary way. What is quite as much to the point is that patients for whom dentures of this sort have been made, willingly pay the increased fee.

The additional time consumed is not as great as would at first appear. It is probable that for the average dentist the time required for making an upper and lower denture will not be increased more than 3 or 4 hours, when enough have been made by this method to familiarize him with the technic. Rapid workmen will greatly reduce this estimate.

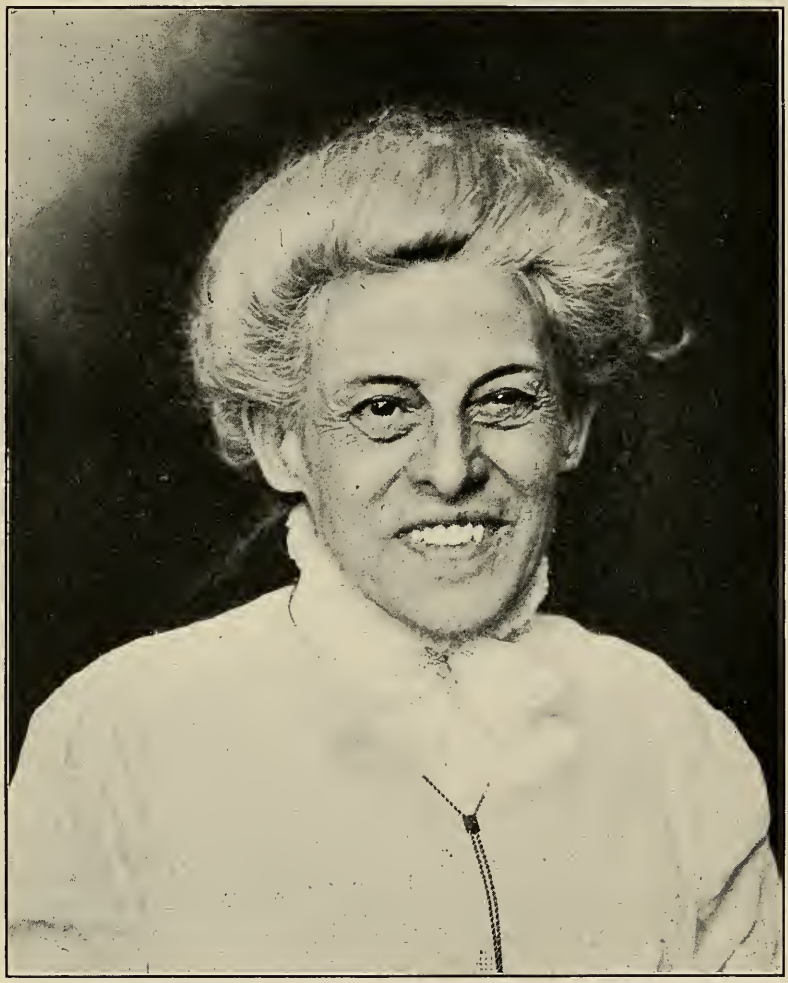
THE MAKING OF PARTIAL DENTURES

It is quite a common experience for dentists to be confronted with the problem of making partial dentures, involving the bicuspid and molar teeth. In such cases, as indeed in all other partial dentures, the service which the dentist renders to his patient can be materially increased by making models of both jaws, mounting them on the articulator precisely as for full plates, working out the condyle paths as suggested in the making of bridges and the building of a partial bite which will show the compensating and lateral curves. Of course in such cases the dentist will use the natural teeth opposing the trial plate as the other denture, and he will be somewhat limited by any unusual positions which these teeth may have taken. But allowing for such limitations, the stability and usefulness of the partial denture may be greatly increased by this method and by so articulating the artificial teeth with the natural teeth that the ordinary masticatory movements art provided for.

Dentists are often confronted with the request to make one denture to articulate with another already in place. It is unlikely that the denture in place is constructed for anatomical articulation, and it will usually be found impossible to anatomically articulate another denture with it.

Under such conditions the dentist is fully justified in persuading

the patient to permit him to make a new denture to replace the one in use. By use of the new moulds of teeth and the method here outlined he can then anatomically articulate both.



ILL. No. 65.—Artificial dentures in place. Teeth selected by the methods suggested in the text.

The greatly improved service which he can render with the correspondingly improved benefits to the patient are ample warrant for such persuasion.

CHAPTER X

SUMMARY OF STEPS IN ANATOMICALLY ARTICULATING FULL DENTURES

Making the Trial Plates.

Secure a good plaster model of each jaw.

Shape a base plate of base-plate gutta percha over each and trim as for a gold base.

With a ruler and a soft pencil, mark on the side of the patient's face, a line from the lowest point of the external auditory meatus to the lowest point of the wing of the nose. This is the "occlusal plane" and the occlusal surface of the upper trial plate must be made parallel with it.

Lay within reach, near the patient, a silver case knife.

Adapt a roll of soft wax to the ridge of the upper base plate. The base plate with the wax ridge attached will be hereafter spoken of as the "trial plate." Support in the mouth with the third finger of the left hand; lay the blade of the case knife from the heel forward on the occlusal surface of the right-hand side of the trial plate, supporting it by pressure of the first and second fingers of the left hand. With the right hand, move the handle of the knife until it is parallel with the line on the side of the face. This will shape the surface of the wax ridge on the right side, parallel with that line. By the eye, trim the other half of the ridge of the upper trial plate to the same occlusal plane.

Trim the ridge of the upper trial plate until it is about a millimeter and a half, 1/16 in., longer vertically in the median line, than the upper lip at rest. Replace the trial plate in the mouth.

Attach a roll of soft wax to the ridge of the lower base plate in a similar manner, making a lower trial plate. Place it in the mouth. Have the patient close the jaws together, until the lips touch lightly in repose. This will give the proper combined height for the trial plates,

and correct the proportionate height for each. The cold and hard upper trial plate will shape the occlusal surface of the lower trial plate to its proper plane.

Mark the labial surfaces of the wax ridges for the sizes of the teeth. Select the mould number by the Twentieth Century Method and lay the teeth aside until ready for use.

Have the patient bite both jaws together in proper relations and make continuous scores across the buccal sides of both trial plates in at least two places.

Remove the trial plates from the mouth; put on the models; place together in right relations. Seal together with a hot spatula.

Getting the Condyle Paths.

Locate on the side of the patient's face, the head of each condyle and make a plainly visible mark over it.

Heat the mouth piece of the face bow and insert into the upper trial plate in proper position. Put trial plates, fastened together with mouth piece attached, into the mouth. Adapt the face bow. Lock the bow and mouth piece together, and remove all from the face and mouth.

Set the model bows of the articulator parallel by means of the set screw. With the articulator sitting upright, slip recesses in heads of the sliding pointers of the face bow over pins on the joints of the articulafor. Move the face bow up and down until the mouth piece and the lower model bow are parallel.

Prop in that position and put upper model in upper trial plate. Push the sleeve on the upper model bow back against the articulator frame and attach the model to the bow in the usual way, enclosing the forward end of the sleeve in the plaster. Invert the articulator, face bow and trial plates; attach the lower model in the usual way, carrying plaster up about the base of the articulator frame. Before the plaster is too hard, cut out the center of the lower model.

Mount the bite gauges in the occlusal surface of the lower trial plate. Put both trial plates into the mouth. Have the patient protrude lower jaw and bite until trial plates come in contact in front. Fasten together with staples at region of cuspids, and seal together on the lingual sides. Loosen the set screws governing the movements of the condyle slots. Mount upper trial plate, with lower trial plate attached, on the upper model, and seal fast. Adapt lower model to rest quietly in lower trial plate and lock the set screws and condyle paths in the slant which permits this position of the model. Remove staples and bite gauges. Engage the spring on the back of the articulator.

Carving the Compensating Curves.

Dust white powder on the occlusal surface of the lower trial plate. Move the upper trial plate laterally on lower, and carve. Attach a conical roll of wax to heel of lower trial plate. Pull the upper model to that side 1/8 in. and close till trial plates are in contact on the opposite side. Trim away the excess buccally and lingually. Carry the slope of the flattened roll into the occlusal surface of the lower trial plate at cuspid. Trim upper trial plate to fit lower all around when in central occlusion. Repeat once or twice, until the heels remain in contact during lateral motion toward that side. Build the other side in the same manner.

Articulating the Teeth.

Cut away half of the ridge of the upper trial plate. Set half of upper set of teeth, beginning with the central. Set occlusal surface of bicuspids and molars against occlusal surface of lower trial plate, as carved. Either purchase the anatomical moulds which permit this or grind the teeth until it is possible. Wax the teeth firmly in position. Set the other half of the upper set beginning with the central. By lateral movements of the upper model, make sure that the buccal and lingual cusps follow the occlusal surface of the lower trial plate properly in lateral and biting movements.

Cut away half of the ridge on the lower trial plate. Set lower first molar, second molar, second bicuspid and first bicuspid on one side in the order here named. Do the same on the other side. Fill in the anteriors to articulate properly and give natural effect. Perfect articulation as far as possible without grinding.

Try the articulated teeth in the mouth. Replace the lower plate on the articulator. Detach the upper model and vulcanize the upper plate in the usual way. After vulcanizing, articulate the upper plate with the lower which is still on the articulator and again attach the upper to the model bow in that position. Vulcanize the lower plate; articulate it with the upper plate and attach to the lower model bow. Place a paste of carborundum powder and oil on the occlusal surfaces of the teeth, press the plates together and move them through all the movements possible to masticating and biting.

For partial dentures, work out the trial plates to the best possible articulation with the opposing teeth and set the artificial teeth accordingly. For bridges, work out models exactly as for partial dentures. Shape occlusal surfaces of dummies so as to avoid destructive or undue lateral strains.

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